

N. D. Sheklakov

Human Skin and Fungi

What
You
Should
Know

Mir Publishers • Moscow

7.25

Human Skin and Fungi:
What You Should Know

~~726~~



302

Н.Д. Шеклаков

Профилактика дерматофитий

Издательство «Знание» Москва

N. D. Sheklakov

Human Skin and Fungi

What
You
Should
Know

Translated from the Russian

by

Elena Shubina



Mir Publishers Moscow

First published 1988

Revised from the 1986 Russian edition

ACC No- 16348

На английском языке

Printed in the Union of Soviet Socialist Republics

ISBN 5-03-000565-X

© Издательство «Знание»,
1986

© English translation,
Mir Publishers, 1988

Contents

Introduction	7
The Structure and Function of Skin	10
Fungi Around Us	19
The Epidemiology of Mycoses	29
The Clinical Course of Fungal Skin Diseases	46
Keratomycoses	47
Dermatophytoses	52
A Few Words about the Control of Dermatophytoses	89
Candidiasis	98
Certain Types of Mycoses Affecting the Skin and Internal Organs	109

Care of Skin: The Basis for the Prevention of Skin Diseases	118
The Fate of Mycoses (Instead of a Postface)	130
Index	133

Introduction

Significant achievements in medicine and public health have been made in the last decades of our century. The morbidity and mortality due to serious illnesses, including infectious diseases, have decreased. Smallpox and poliomyelitis have become history, and our children no longer suffer from outbreaks of diphtheria and whooping cough. But a number of contagious diseases still trouble mankind, and fungal diseases, i.e. mycoses, occupy a special place among them. Some fungi become more prevalent and manifest themselves in the most unexpected situations.

...The kidney transplantation is over. Everything has been thought out and provided for to the smallest detail. The last suture is applied, and the patient is taken to a special ward with thoroughly disinfected equipment and air-conditioning. The desperate struggle by the physicians to keep the transplanted kidney functioning and to ensure its compatibility with the patient's body continues for several weeks. Special immunosuppressants and hormones (corticosteroids) are given. Antibiotics are

injected to the patient to combat pyogenic cocci.

Everything seems to have been done to save the patient's life, to prevent the rejection of foreign tissue. But quite unexpectedly, the inflammatory reaction develops, which is caused by the yeast-like fungi often inhabiting the intestine, skin, and mucosa of man. Microorganisms, which are usually quite 'peaceful', suddenly become aggressive. Such complications after the organ transplantation are quite common in the early postoperative period.

Well, the reader may say, these cases are extraordinary because the tissues and organs are transplanted not every day and not to everyone. That is true, but antibiotics and hormones, e.g. tetracycline or prednisolone, are quite frequently used in everyday life, and their abuse leads to the enhanced growth of fungi, which is far from safe even with small daily doses.

This, however, is not the main reason for the spreading of fungi. According to world statistics, every fifth inhabitant of the Earth suffers from dermatophytoses, i.e. diseases of the skin and its appendages (nails, hair), as a result of fungal infection.

It may happen that vesicles develop on the foot of a family member. He or she pays no attention to this, but some time later similar symptoms of mycosis of the feet are found in other members of the family. If the infected person goes to a public sauna or swimming pool, other

people attending these facilities may become infected as well.

This book acquaints the general reader with the spread of fungal diseases, features of their clinical course and prevention. Descriptions of fungi and mycoses caused by them are rarely found in the popular literature, whereas many books and brochures are devoted to bacterial and viral infections. The author decided, therefore, to try to fill this gap.

The author's aim is to inform the reader about the properties of fungi, the main characteristics of the clinical course, epidemiology, and prevention of the most widespread dermatophytoses and other types of mycoses affecting the skin and mucosa. This book is mainly devoted to these aspects of medical mycology.

The Structure and Function of Skin

The skin has a complex structure and consists of several layers. Many nerve endings, blood and lymphatic vessels, sebaceous and sweat glands are invested in the skin.

Two layers of skin are distinguished: epithelium (epidermis) and connective tissue (dermis and hypodermis). Differing from each other by their morphological and physiological properties, the two layers make a single whole. The thickness of epidermis does not exceed that of a safety-razor blade (less than 0.1 mm); only on the palms and soles does the horny layer of epidermis sometimes reach 1.5 mm. But this relatively thin coating of our body invests a lot of cells, which differ in form and function.

The epidermis consists of five layers: (1) germ or basal-cell layer; (2) prickle-cell layer; (3) granular layer, or layer of Langerhans; (4) clear layer, or layer of Oehl, and (5) horny layer.

The *basal-cell layer* is the deepest of all epidermal layers. It borders the dermis and is composed of a single row of regular co-

lumnar cells, epidermal cells, which are reproduced here; hence, the name germ layer. The cells of this layer produce the pigment melanin. The amount of pigment usually increases due to exposure to ultra-violet rays, which results in a suntan.

The *prickle-cell layer* overlies the basal-cell layer; its cells are polyhedral and joined by protoplasmic processes which appear as prickles, hence, the name prickle-cell layer. The basal and prickle-cell layers play the major role in the functioning of the epidermis: metabolic processes take place in their intercellular spaces.

Dystrophic changes, such as swelling or spongiosis, which is the intercellular oedema especially characteristic of eczema, occur in pathological processes in the cells of the prickle-cell layer. When the prickle-cell layer proliferates, the amount of cell rows may increase, which is observed, for instance, in lichen psoriasis.

The *granular layer* consists of spindle-shaped cells containing the grains of keratohyalin, which is necessary for keratinization of the epidermal cells.

The *clear layer*, which has the form of a thin plate, separates the overlying, i.e. the horny, layer from the granular layer. It is composed of flattened anuclear cells; their protoplasm contains the special substance eleidin.

The *horny layer* is the outermost layer of the epidermis consisting of anuclear cells. The superficial cells of the horny

layer are constantly desquamated, particularly in infants. Thickening of the horny layer of the skin, e.g. callosity, is called hyperkeratosis.

The epidermis borders the true skin, or dermis. The latter is conventionally divided into two layers: (a) the superficial papillary layer located between epithelial bands, and (b) the deep, or reticular layer.

The dermis is composed of collagen and elastic fibres, which are interlaced. In addition, muscles are located deep in the skin. The deepest layer of dermis borders the hypodermis, the subcutaneous connective tissue. The skin and subcutaneous connective tissue protect the deeply lying tissues from various harmful effects.

The blood vessels of the skin form two networks, which ramify in a horizontal plane: superficial (at the base of papillae) and deep (at the border of the skin and subcutaneous fat). The dermis reddens, becomes oedematous and infiltrated due to dilatation of vessels in pathological processes. The skin is richly supplied with sensory receptors, and the papillary layer contains tactile nerve endings, which are especially abundant on the inner surface of fingers.

Hair, nails, sebaceous and sweat glands are skin appendages. The root of the hair is contained in the hair follicle, i.e. an invaginated tube of epidermal cells lying in the corium of the skin. The lower part of the hair follicle rests on the hair papilla.

Hair is differentiated as long, coarse and downy hair. The hair on the cheeks, upper lip, chin and partly on the neck in men, axillary and pubic hair, and hair on the head of both men and women is considered long hair. The hair of the brows, eyelids, nostrils, and the external acoustic meatus, particularly in elderly people, is coarse and usually short. The downy hair covers the skin of the upper and lower extremities, the back and abdomen, and the facial skin in women. Growth of downy hair differs markedly.

Nails, which are another skin appendage, are horny plates resting in special nail beds. The nail plate has a smooth, lustrous outer surface, which is light pink in young people due to capillaries permeating the underlying skin. The nail plate has a root and a free border. The nail plate along the lateral borders and at the root is surrounded by a nail fold.

Thus, the skin is a very complicated organ. Considering the fact that the skin surface area of an adult is 1.5-2 square metres (depending on the body height and weight), and its weight, including the weight of subcutaneous connective tissue, constitutes 15 per cent or more of the body bulk, the great significance of skin in the body functioning becomes obvious.

The functions of skin are very diverse. Sensations of pain, pressure, touch, cold, and warmth are quickly and distinctly perceived by sensory receptors of the skin.

The skin of blind people additionally performs more subtle tactile functions so that the absence of visual analyser is, in fact, compensated for to a certain extent. We know that blind people can read fluently by feeling the raised dots symbolizing letters in special books. They can discern things and faces of people with their fingers.

The skin also has other important functions. It helps to maintain a constant body temperature. When exposed to cold, the vessels contract, reducing the heat loss. On the contrary, in warmth the vessels dilate, perspiration increases, and the body temperature falls. It is not without reason that the skin is called the thermal sluice of the body! In fact, wide branches of capillary network invest the skin. During maximum tonus of vessels the capillaries contract to such a degree that even blood corpuscles cannot pass through, and only the blood plasma leaks out. And vice versa, when the skin capillaries are dilated abruptly, a considerable part of the circulating blood accumulates in their lumina. We provoke such a blood redistribution artificially by applying mustard plasters, dry cups, fomentations, and by massage.

In the mouth, nostrils, eyes and other natural orifices of the body the skin turns imperceptibly into mucosa. This continuity in skin covering reliably protects all parts of the body. The mucosa lacks the granular layer of cells, which makes them transparent. Therefore, the pink colour of blood

in the capillaries can be seen, for instance, through the mucosa of cheeks.

What other functions does the skin perform? The sebaceous and sweat glands require special attention. The former secrete sebum, which is particularly important for the normal growth (and appearance) of hair, making it elastic and lustrous. If the hair follicle lacks a sufficient amount of secretion, the hair becomes dry, brittle, and dull.

About 90 per cent of the skin's sebaceous glands are associated with hair. But there are free sebaceous glands, opening directly onto the skin surface. Only the skin of the palms and soles lacks sebaceous glands.

The functioning of sebaceous and sweat glands changes in accordance with the environmental conditions and a person's age and health.

Many of the readers are probably familiar with juvenile acne, which is the result of enlargement and inflammation of sebaceous glands. This usually occurs during the pubertal period and testifies to the fact that the sebaceous glands and their secretions are closely related to the internal, in the first place hormonal, regulation of body functioning.

The droplets of fat-like substances secreted by the sebaceous glands contain essential metabolites, such as hormones of the adrenal cortex and sexual glands, fat soluble vitamins, and some enzymes. The sebaceous glands can produce up to 50 g of secretions

daily. As a result, a very thin, fatty, more precisely, emulsified (mixed with sweat), coating is formed on the skin surface of the whole body, which plays a great role in the protection and maintenance of its functioning.

This fatty secretion makes the horny (epidermal) layer elastic and protects it from microscopic fissures and ruptures that may allow infectious agents to gain entry. In addition, sebum contains substances, such as complement and lysozyme that inhibit the growth of harmful microorganisms.

This sebaceous secretion prevents maceration of superficial skin layers and also protects against excess drying of the epidermis. Fatty coating partly impedes the penetration of harmful substances into the skin.

Many waste metabolites, rejected cells, and even toxic substances of external or internal origin are excreted together with sebum.

Sweat glands are no less important. They secrete sweat and some liquid fatty acids. Man has enormous number of sweat glands: more than two million, which is almost ten times more than the number of sebaceous glands.

Mineral and organic substances, particularly such metabolites as urea, ammonia, and lactic acid, are dissolved in sweat. In other words, to a certain extent, the skin facilitates functioning of the kidneys and urinary ducts.

Physicians rely on the ability of the skin to maintain the water-salt metabolism: in cases where it is necessary to lessen the load on the kidneys, patients are recommended to visit a health resort in a hot and dry climate.

A human being can actually secrete almost 30 g of sodium chloride daily (a whole handful!) by performing prolonged physical work in warm time of the year. That is why the shoulders of soldiers' shirts are covered with real salt after a long march. The sweat-soaked clothes of peasants and workers fade even without the sun, being made colourless by ammonia (alkali!) and volatile acids of sweat.

Unlike sebaceous glands, sweat glands are also found on the skin of palms, which is manifested by moist palms, for instance, after work, in excitement or other emotional reactions. If you feel moist palms while shaking hands with a person, this suggests disturbances in the vegetative nervous system or dysfunction of the endocrine glands.

Usually sweat secreted by the skin of the palms and soles does not have a strong odour. In metabolic disorders or (most often) poor hygiene of the body the sweat, especially of the soles skin, has an unpleasant odour. In the latter case this odour is caused by decomposition of organic substances in sweat by microorganisms, including yeast-like fungi.

Thus, the skin has a protective function: it maintains the equilibrium in the internal

medium and protects the body from penetration of virulent bacteria and noxious substances. The skin protects us from the harmful effects of ultraviolet rays. It is also the most important organ of thermoregulation, maintaining the required temperature of the body. In addition, it is a sensory organ (mainly of tactile sensation).

The skin takes part in metabolism and is a kind of blood depot due to the capillary network; it also regulates the quick release of water and mineral substances, especially salts. The skin plays an enormous role in excreting metabolites and harmful substances.

The skin also functions as a peculiar screen of internal organs condition. Acupuncture is based on the theory that every organ is 'represented' on the skin surface, and it has existed for thousands of years.

These relationships have not yet been fully revealed, but their mechanisms, probably, have a larger sphere of action than previously imagined. It is known, for instance, that the intracutaneous injection of some vaccines and other protective and therapeutic preparations is more effective though the dose of these drugs may be hundreds of times smaller compared to subcutaneous or any other injection. Hence, even immunological processes are connected with skin reactions.

All these vital functions of the skin can be impaired by microorganisms penetrating into the skin, which are, primarily, patho-

genic fungi that cause fungal diseases.

What are the characteristics of microscopic fungi? How do they spread and invade the human body?

Fungi Around Us

Mushrooms have been known to man since ancient times, but usually we think of them as edible or poisonous mushrooms that are found in the forests, fields and mountains. Some of them are large in size. The diameter of the fruiting body of a polyporus, for instance, reaches 1.5 m. Boletus and other kinds of edible mushrooms weighing 2-3 kg or more are frequent finds.

This book, however, is devoted to microscopic mushrooms, i.e. those invisible to the eye. All of us are familiar with mould, the woolly growth frequently seen on foodstuffs or on the surface of various objects kept in a humid environment. We can discern the structure of such mushrooms only through a microscope.

Nowadays, microscopic kinds of mushrooms are called fungi, though not all researchers agree with it. But since this is adopted, we shall also call them fungi in this book.

The invention of the microscope greatly broadened our knowledge of fungi. It turned out that not less than 100 000 of fungal species exist on the earth. They are studied

in mycology. This field was originally represented as a part of botany; its borders are now extended, and it has become an independent branch of science.

Microscopic fungi live everywhere—in soil, water, and air. At the beginning of the 20th century the famous Swedish scientist and Nobel prize winner, Svante Arrhenius—creator of a number of scientific trends in natural science, chemistry, and biology—put forward an original hypothesis on the origin of life on earth. He believed life on our planet to spring up with the help of fungal spores that could endure the cold in space and could move influenced by light flux or other flows of substance and energy in the Universe. This interesting theory had a lot of advocates, including the Russian scientists V. I. Vernadsky and K. E. Tsiolkovsky.

The above-mentioned hypothesis of 'panspermia' has not yet been confirmed, but the fact of its existence is remarkable because scientists look for possible signs of life in space exactly among fungi. The extent to which the spores of fungi can disseminate and are resistant to the environment has been shown. They really do not fear either space cold, or radiation.

The case is known where in November 1973 the American astronauts of the next shift, having arrived at the Skylab space station, found a thick moss of mould on clothes and protective suits left by their predecessors. They had to take decisive

measures to combat the fungi on the spaceship.

It is now hardly possible to find a branch of economy where data of mycology are not directly or indirectly used. Wine-making and brewing, for instance, cannot manage without fungal microorganisms, i.e. yeast. In fact, it was in this field where the scientific activity of Louis Pasteur began. He demonstrated, for example, that contamination of fermenting agents by 'wild' species of yeast result in diseases of wine and beer. These invisible toilers take part in making bread and dairy products.

Enzymes and acids, alcohol and aromatic substances are produced with the help of yeast. Fungi decompose plants debris and other organic matter, thereby enriching the soil and improving its fertility.

The yeast has absolutely fantastic ability to synthesize proteins, which is now used in fodder yeast production. The dry substance (90-95 per cent) of yeast cells is composed of proteins (50-60 per cent), nucleoproteins (25 per cent), purine bases, fats, carbohydrates, and vitamins. Yeast is a real pantry of nutrients. This is why the production of fodder yeast and protein-vitamin concentrates is rapidly increasing.

The discovery of antibiotics in 1928 was also connected with the omnipresence and unpretentiousness of fungi. Alexander Fleming (1881-1955), a British microbiologist from the bacteriological laboratory of St.

Mary's hospital in London, made the discovery as follows. While experimenting with various types of staphylococci, he left some Petri dishes with cultures on the laboratory table and, occasionally, examined them. On inspecting, the dishes were, naturally, opened, which made possible their contamination by various micro-organisms. Fleming noticed that the colonies of staphylococci gradually became more transparent and were, probably, destroyed near a large colony of moulds got there from the air.

By that time Fleming already knew about lysozyme, the enzyme present in saliva that decomposed microbes and gave similar results in culture. Therefore, he noticed the destroyed bacterial colonies and immediately related this to the presence of mould. The microbiologist obtained a substance from the filtrate of the culture on which the mould grew and called it penicillin after the fungus *Penicillium notatum*. The results exceeded all expectations: even being diluted as 1 : 1000 a single drop of this filtrate destroyed staphylococcus completely.

To obtain the antibiotic, the concentrated form of the active substance was needed. Chemists began working and obtained penicillin in pure and dry form by the beginning of World War II. Since that time antibiotics have been extracted from various kinds of fungi: more than 1000 different antibiotic preparations are now known.

Our century is called not only the era of space exploration or the atomic era, but also the era of antibiotics, for during the 50 years of industrial production antibiotics saved millions of human lives from imminent death.

But, as the saying goes, the medal has a reverse side. There are fungi that frequently bring harm to man. In some years up to one-quarter of the harvest of fruits, berries, and vegetables perishes as a result of fungi attack. Fungi can even 'cope' with building materials, fuel, and lubricants; they can corrode metals and destroy plastic materials. Transport and industry accidents are known that were caused by the growth of mould, e.g. in aviation fuel.

Numerous branches of industry that utilize fungi have emerged in connection with great significance of fungi in various spheres of human life and activity. New trends have arisen in mycology, including the industrial mycology of forage, foodstuffs, and antibiotics and many divisions of agricultural and veterinary mycology.

Medical mycology is also of important scientific and practical value: it studies the causative agents of human fungal diseases, i.e. mycoses.

Intensive research aimed at studying the role of fungi in human and animal pathology is being carried out in the USSR and in a number of other countries. The school in mycology headed by Professor Kashkin from Leningrad, one of the authors

of fundamental manual in medical mycology, is well known.

At the Moscow Central Research Institute of Skin and Venereal Diseases Professor Leshchenko is engaged in studying the causative agents of mycoses. The second edition of his book on the laboratory diagnosis of fungal diseases has been recently published. Much work has been done lately in veterinary mycology by Petrovich, the author of a monograph on mycotic diseases in animals. The significance of these works should be emphasized because it is difficult to diagnose mycoses without using laboratory methods.

What do fungi look like and what are the features of their development?

Fungi occupy a special place in the organic world. The presence of chitin in their cell membranes and the participation of urea (nitrogen) and glycogen (carbohydrate) in their metabolism bring them closer to animals. However, fungi most likely resemble plants by the mode of nutrition by osmosis (absorption and not swallowing) and by unlimited growth. True, fungi neither contain chlorophyll nor synthesize organic substances from the carbon in air because they get them ready-made: they feed on the living or dead tissues of plants and animals.

But be that as it may, fungi are representatives of plants. Unlike higher plants the body of a fungus is not divided into the root, stalk, and leaves. The cell of a

fungus consists of the membrane and cytoplasm with the following organelles: a membrane, mitochondria, ribosomes, other inclusions, and, of course, nuclei.

The bulk of the body of microscopic fungi is made up of specific tubular threads or hyphae whose aggregate is known as mycelium. A spawn is the system of branching hyphae on the surface of a substrate (soil, tree, animal tissues) through which nutrients are absorbed by osmosis. Various metabolites of fungi, such as antibiotics, enzymes, vitamins, and toxins, can accumulate in cells.

When examined in the light microscope, the fungal membrane appears colourless or slightly stained. Several layers can be seen under the electron microscope.

How large are microscopic fungi? Yeast cells may not exceed a micron in size while the fungus cells of the genus *Mucor* are hundreds of microns in diameter. The terminal filaments of some fungi resemble the tendrils of wild strawberries and fix the spawn to the nutrient medium where they grow rapidly.

Fungi have a complex classification characterized by the prevalence of several main groups differing in appearance.

The fungi of the genus *Aspergillus* have characteristic conidia or exospores, which rest on a conidiophore terminating in a vesicle. *Penicillium* fungi look different: at the ends of mycelium some of them have macroconidia, by the appearance of which

ditions change dramatically.

The diverse pathogenic types of fungi (more than 100 thousand) are separated into four classes: Archimycetes, Phycomycetes, Ascomycetes, and Basidiomycetes. In addition, there also exists the class of 'imperfect' fungi.

Archimycetes and Phycomycetes belong to the lower fungi. The former do not have a mycelium or have a rudimentary one; the latter are characterized by sporangia containing spores.

The structure of a spore-bearing organ in Ascomycetes and Basidiomycetes (higher fungi) is more complicated. All of them have sexual and asexual cycles of development. Sexual spore-bearing is absent in imperfect fungi.

The clinical classification of fungal diseases developed by Sheklakov (1976) has been adopted in this country. It is based on already existing classifications of fungi and fungal diseases as well as on the official data of the World Health Organization compiled in the book 'International Classification of Diseases'. According to this classification, fungal diseases are divided into keratomycoses, dermatophytoses (most frequently found in man and animals), candidiasis, and deep mycoses.

The same classification principle is used in the clinical part of this book. But before describing the clinical course of diseases, it is necessary to characterize briefly the epidemiology of mycoses.

The Epidemiology of Mycoses

Mycoses spread by different routes. The most common is the contact-household route, by which fragments of epithelium, hair, and nails affected by fungi are transmitted by shoes, clothes, and instruments. Disrupted skin continuity (injury, intertrigo) is conducive to the penetration of fungi into the skin and the development of dermatophytoses.

In other words, the causative agents of dermatophytoses are transmitted by direct (contact with affected parts of the body) or indirect (through household articles) routes. The fact that fungi are specifically attracted to the skin surface is also important. Some permanent skin and mucosa inhabitants, for instance the yeast-like fungi of the genus *Candida*, are able to cause disease when the body's defensive forces are weakened. In short, these fungi become aggressive only under certain conditions.

Sometimes dermatophytes spread with sewage but in intestinal infections the route of fungi spreading is different. Only certain mycoses can be transmitted by water or food. True, such diseases commonly occur as mycotoxicoses, when the toxin of the food affected by mould gets into the body and causes poisoning.

Fungi are not infrequently isolated by scientists from reservoirs contaminated by garbage and dirt. The clear running waters of reservoirs, particularly rapid streams

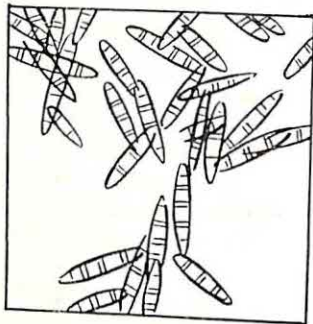


Fig. 1. *Microsporum gypseum* (a lot of macroconidia are seen)

one can determine, for instance, the presence of parasitic dermatophytes (Fig. 1).

Fungal reproduction occurs in two ways: sexually and asexually. In the former case the fusion of cell nuclei and their subsequent division take place. In asexual reproduction organs form that contain spores which can be resistant to harmful environmental influences, germinate in appropriate conditions, and produce offspring.

Depending on the ability to grow at a certain temperature, fungi are divided into psychrophilic fungi which prefer cold (approximately 0°C), mesophilic fungi which grow at moderate temperatures ($10^{\circ}\text{--}38^{\circ}\text{C}$), and thermophilic fungi which require (or withstand) relatively high temperatures (up to 50°C) both in sporiferous and vegetative conditions.

Under the microscope, fungi look different, depending on their type and the devel-

opmental stage. There are four phases of fungal growth: (1) germination of conidia, formation of germ tube and primary mycelium; (2) active growth and branching of mycelium; (3) uniform growth; (4) aging or fading of metabolic processes.

Despite the diversity of their outward appearance, many fungi have common biological properties. They require the oxygen of air, sufficient humidity, and a specific temperature for their growth. The majority of fungi prefer an acid medium though some of them also grow in an alkaline medium.

Different types of fungi are distinguished, according to the features of nutrition and places of habitat: soil, phytopathogenic (causing disease in plants), entomophilous (insect parasites), zoophilic (animal parasites), and anthropophilic fungi (pathogenic for human beings).

On the whole, fungi are divided into saprophytes and parasites. The former dwell outside the living organism, feeding on various organic substances. But some of them inhabit the human body without causing any harm up to a certain moment (conditionally pathogenic types). Pathogenic fungi, however, have adapted to a parasitic mode of life, and they do not easily survive outside the body. The virulence of pathogenic and conditionally pathogenic fungi depends on certain conditions: for instance, when a lot of them infect a weakened body or when the environmental con-

and rivers, do not contain pathogenic fungi. It is only the non-disinfected water of swimming pools that can be a source of fungal diseases.

Foodstuffs, such as milk and dairy products, sweet drinks, curds, baby food, fermented vegetables containing *Candida* fungi, and also vegetables and fruits, are of definite epidemiological significance. Heat-treated meat and fish products, as well as pasteurized drinks, do not contain pathogenic fungi. Water and food can be contaminated with *Candida* fungi by carriers; insufficiently treated foodstuffs can also be contaminated by fungi from dirty crockery.

If the sanitary rules are violated, the sewage of baths, floors, and walls, gratings and floor mats in bathhouses may be contaminated with dermatophytes, particularly with the causative agents of mycoses of feet. The sewage water from bathhouses almost always contains yeast-like fungi.

Working in baths, carriers may contaminate the premises with the causative agents of feet mycoses, *Candida* fungi, and, thus, be a constant threat of infection for those visitors who do not observe the sanitary rules.

Dermatophytes can also be spread by the instruments, shaving and hair brushes, towels, and uniforms of personnel at hair-dressing salons.

Inadequate disinfection of baths and washbasins in bathhouses as well as ineffec-

tive sterilization of shaving and hair brushes and hair-cutting instruments at salons also predispose to the contamination of people.

The bites of blood-sucking insects are another way of spreading the causative agents, known in epidemiology as the transmission route. These are blood infections because they are transmitted when the microorganisms directly invade the blood. They include natural foci of tick-borne encephalitis, epidemic typhus (with louse as the carrier), and malaria transmitted by mosquitoes.

This route of infection is not encountered in dermatophytoses though it is possible in other types of mycoses. In fact, this is a mechanical transmission of fungi by ticks, gadflies, lice, and other arthropods.

The aspiration route of infection by fungi through the lungs is also known. In dermatophytoses the fungi may spread with dust but this does not lead to infection through the airways owing to the biological features of the fungi (they are dermatotropic). On the contrary, there exists a group of mycoses whose causative agents spread with dust. These are, for instance, North and South American blastomycoses that can cause severe disease when they penetrate into the airways (and other organs).

It should be mentioned that due to their evolutionary adaptability the spores of fungi are commonly spread by air currents. Thus, transmission by air and dust may be

possible for many pathogenic fungi except for, perhaps, the dermatophytes. Thus, the leading source of infection in dermatophytoses and in some other mycoses is a sick person.

Animals affected by pathogenic fungi serve as an important source of infection. The fungal infection usually runs an undulant course in populations of wild and domestic animals, depending on the age of species, the density of habitat, their migration, and climatic factors, particularly the season.

Anthropogenic factors play a definite role in the development of epizootic process. This is particularly manifested in mycotic infection of farm animals among which epizootic diseases usually occur under the following conditions: (1) keeping the animals in a stall; (2) a high density of livestock; and (3) unfavourable natural factors (lack of forage and ultraviolet rays, and the presence of rodents, carriers of mycoses).

In some zoonotic dermatophytoses, rodents and other domestic animals, such as cats and dogs, may play a significant role in spreading the fungi to the human environment.

Many fungi can also affect man while parasitizing on farm and domestic animals. Numerous cases of trichophytosis among people caused by their contact with sick horses, cows, and sheep have been described. After the vaccination of cattle with the special vaccine the elimination of *tricho-*

phytic infection in livestock was made possible in almost all the regions of this country.

At present, zoophilic microsporum (*Microsporum canis*), which was formerly often referred to as *Microsporum lanosum*, is rather widely spread in this country. Its hosts in nature are cats, dogs, and also foxes. This fungus sometimes circulates among zoo animals, causing the disease not only in animals of the cat family but in the attending personnel as well.

People, especially children, most frequently become infected with this fungus from stray cats and dogs. Parents must, therefore, prevent contact of children with these animals, and children must carefully watch their own pets.

Being sufficiently stable in the external environment, fungi can parasitize for a long time on plant and animal remains from where they get into the soil, air, and water: this has epidemiological significance. For example, massive contamination with fungi of children's sandboxes that are frequented by animals, especially cats, is known to occur.

In nature the reservoir of mycoses is connected with the saprophytic way of life of some pathogenic fungi in the soil, on the decaying stubs of trees, or in dead animals. That is why many fungi are spread by the soil, more commonly in the form of dust. The number of causative agents of mycoses in the external environ-

ment varies widely depending on the weather, season, urban or rural conditions. Thus, certain types of pathogenic microorganisms prevail in rural areas while other types of them predominate in town.

The spring months facilitate the growth of fungi in the soil; in summer, when the soil dries, the infected dust is carried over large distances by air currents. The cold winter months favour the infection and dissemination of fungi among susceptible farm animals due to the high density in their stalls and the migration of mouse-like rodents to cattle-sheds and then to the houses of people.

In addition, the soil is an independent reservoir of fungi in nature. The high endemicity (prevalence in a particular territory) of certain mycoses, particularly the American blastomycoses, is related to this.

Due to the high dispersion of fungi many thousands of people and animals may get infected. However, they are often the end point in the circulation of a certain type of fungus, since further infection of living creatures and objects in the environment does not take place. Dermatophytoses are also characterized by some signs of endemicity, but the majority of the main dermatophytes are encountered in all countries of the world, in different geographic zones.

Thus, the following types of fungi are distinguished: endemic (pertaining to a definite locality) and diffuse (pertaining

to all countries) fungal species, which can be zoophilic or anthropophilic (characteristic of man only). Saprophytic fungi, which make up a special group, are dangerous for humans only if they get into the 'zone of fungus activity'. Unlike anthropophilic and zoophilic fungi, which have adapted through evolution to dwelling on the animal body, the pathogenicity of saprophytic fungi for man and animals is not fixed by a permanent contact, it is incidental like the danger of toxins from a fly agaric or death cup for man.

Infection with mycoses probably occurs more frequently than reported. Perhaps, this also refers to such mycoses as sporotrichosis and chromomycosis, which are widely spread in this country. Gardeners, flower-growers, and agronomists, who work with plants, are relatively often susceptible to fungal diseases, because the causative agents of, for instance, sporotrichosis frequently live in plants.

The pathogens of actinomycosis (conventional fungus) may also penetrate into the body through injured mucosa from dust or plants; for example, cases of infection are known after picking one's teeth with a blade of grass.

Fungi propagate in the body by the spreading of mycelium to fresh foci of tissues and the mechanical transfer of spores to new skin sites (for instance, in scratching the primary foci of affection with dermatophytes). If the spores get into the blood

or lymph flow, a disseminated (systemic) mycosis may occur.

Occasionally, groups of miners are infected with sporotrichosis and groups of agricultural workers with actinomycosis. On the whole, such infections occur sporadically as a result of accidental infection with pathogens inhabiting the soil. This takes place in the following cases: (1) considerable contamination dose; (2) weakened body's resistance (malnutrition, etc.), and (3) hypersensitivity to mycotic infection.

Many virulent fungi are less contagious for man than pathogenic bacteria. The causative agents of coccidioidosis, blastomycoses, histoplasmosis, and also such dermatophytosis as microsporosis caused by *Microsporum ferrugineum* are especially virulent for man.

Along with highly pathogenic fungi, there exist less dangerous fungi, which infect humans only in aggravated conditions, particularly when the body's resistance is decreased by some pathogenic factor.

As has already been mentioned, fungi are either anthropophilic or zoophilic. As a rule, the dissemination of anthropophilic fungi is mainly influenced by social conditions, while the circulation of zoophilic fungi largely depends on natural factors determining epizootic conditions (spreading of mycoses among animals).

What are the natural factors of the epidemiology of mycoses?

Performing our instructions, the physicians Letuta (in Kazakhstan) and Grakovich (in the Kamchatka region) studied for a long time the influence of different meteorological and other natural conditions on the incidence of microsporosis caused by zoophilic fungi.

What are the specific features revealed by these investigators?

The analysis demonstrated the obviously seasonal character of the morbidity rate, which rises during autumn and winter months and falls in spring and summer. In different years the seasonal rises vary in amplitude, which is expressed in a larger or smaller number of patients.

It was established that cats and, less often, dogs are the main source of infection in people. Children are mostly susceptible; they get infected in the yards, playgrounds, stairwells, and other premises where sick animals happen to be. The maximum incidence of microsporosis among animals, followed by the maximum incidence among the population, is reported in East Kazakhstan after the maximum precipitation in warm season of the year. Hence, the morbidity rate depends on weather conditions.

The growth and development of fungi are greatly influenced by seasonal factors. For example, cultures of the genus *Trichophyton* grow intensively from January to March, their development is hindered from May to August, and active growth is

resumed from September to October. Similar changes are observed in other types of fungi, which is, of course, epidemiologically significant.

Apparently, external factors greatly influence the vital processes in fungi, leading to alterations in their biochemical and other properties. In particular, a change in the pathogenicity of fungi is observed that coincides with intensification of their growth, i.e. the ability to overcome the defense mechanisms of the host, causing a virulent effect in different seasons. The virulence, which is a degree of pathogenicity, varies rather widely in separate cultures of fungi.

Largely significant are periods of animals breeding in the natural foci: the young species that discharge the active cultures of fungi become involved in the epizootic process.

Natural factors affect the incidence and spread of mycoses. Usually warm seasons of the year, particularly transitional periods (spring, autumn), are conducive to the development of fungi. In winter their spread is favoured by the high density of domestic animals in stalls. When mouse-like rodents are the carriers of mycotic infection, a clear-cut correlation is observed between the numbers of these rodents and the morbidity rate of the population. For instance, domestic animals (cats, dogs) are infected by these wild mouse-like rodents, after which the probability of in-

fecting people with zoophilic trichophytosis arises.

Since the main source of infection in microsporosis caused by zoophilic fungi are cats (especially kittens), their breeding cycle is also important for epidemic control measures. In the Kamchatka region, cats have two or even three litters during the year: this means that many of their progeny turn out to be homeless. Cats take shelter in porches, in attics, or live in the yard. If cats get infected with fungi, the disease quickly spreads in their population, leading to a high risk of infection among people, especially children.

Now we shall briefly describe the territorial dissemination of some mycoses. Some fungal diseases (candidiasis, dermatophytoses, cryptococcosis, and mould mycoses) are widely diffused and encountered in all climatic zones, while others (sporotrichosis, mycetoma, chromomycosis, etc.) affect a rather limited number of people though they are found almost everywhere.

Finally, some mycoses are limited to endemic areas. They include, for instance, coccidioidomycosis and North and South American blastomycoses. In the endemic areas, where these mycoses are present, the number of patients reaches tens of thousands; in addition, the pathogens affect an enormous amount of domestic and wild animals. Also, the fungi develop in the soil in these dangerous endemic locations.

Humans and animals are accidental hosts

for fungi. The diseases caused by these fungi are limited to groups of people who breathed once or for a long time the air contaminated with fungal spores from the soil. In the organs of such people and animals, the pathogens of coccidioidosis, histoplasmosis and blastomycoses develop in the parasitic (tissue) form, which differs markedly in its biological properties and contagiousity from the dangerous infectious stage of fungal development in the soil. Infection resulting from contact between humans almost never occurs in these mycoses.

Fungi of the genus *Candida* constantly inhabit the body of humans; candidiasis in adults and children mainly develops as an autogenous infection of a weakened body. Infection may occur when the foetus passes through the birth canal and also as a result of direct and indirect contact with carriers.

Thus, along with highly pathogenic fungi, which are dangerous for all hosts (for example, the causative agents of coccidioidosis, histoplasmosis, blastomycoses), less dangerous fungi are encountered and also conditionally pathogenic fungi, which cause a disease only when the state of the body is aggravated.

The important role of saprophytic fungi in human pathology has been revealed recently. They do not cause any infectious process, but their antigenic components and metabolites induce mycogenic sensitization, which occupational allergic diseases are

associated with. This happens, for instance, while working with fungi, producers of protein and polysaccharide products that are of great economic value. These are, in brief, the natural biological factors of the epidemiology of mycoses.

What are the social factors involved in the epidemiology of mycoses?

The occupational incidence of mycoses is, first of all, meant; most characteristic in this respect are the enterprises of microbiological industry. Thus, mycoses may be spread by fodder yeast production plants and by enterprises for obtaining yeast from the liquid paraffin of oil, the annual production of which may reach 200 000 tons. Although the types of fungi used in the microbiological industry are non-pathogenic, the concentration of mould and yeast-like fungi is so high that sometimes contact with them over long periods becomes dangerous for humans.

The spores of mould and yeast cells can get into the respiratory tract and onto the skin inducing pathological processes and allergic sensitivity in some cases. This particularly concerns people with decreased body resistance, suffering from chronic diseases and predisposed to allergy.

The dissemination of viable yeast-like fungi in the fermentative and separation departments or on the cooking floors is possible leading to the development of candidiasis in the respiratory tract and fungal allergy in people working or living in the

area of the microbiological enterprises, for instance, near plants for fodder protein production based on the use of microorganisms. Although practically harmless types of fungi are utilized, the sensitization to their proteins and, hence, the development of dermatoses are possible.

All this has required the elaboration of safety rules for the enterprises of microbiological industry to control the conditions of labour and also to organize sanitary-protective green zones around the plants (taking into account the wind rose, capacity of enterprise, etc.). The existing technology guarantees the airtightness of equipment (to avoid dissemination of nutrient medium with fungi), suction-and-exhaust ventilation with filtration of expelled air, and other preventive measures, which almost completely reduce the possibility for microorganisms to get into the environment.

When houses, classrooms, or industrial premises are cleaned in dry conditions, fungal spores constantly circulate in the air. These are mainly non-pathogenic species of *Penicillium* and *Aspergillus*. Their spores are also found in the humid air of damp, poorly ventilated premises where walls, furniture, and food can become mouldy.

The reader may remember instances when upon returning home from a business-trip or holidays the smell of mould growing in a tin accidentally left open or a cup with tea remains could be detected. This means that there are fungal spores in the air. Their

dissemination in industrial conditions is more dangerous.

The occupational disease called aspergillosis has long been known to science. A special term, 'farmer's lungs', is used to denote diseases that develop as a result of contact with mouldy hay, fodder, grain, cotton, etc. The disease is characterized by affection of the lungs and specific disturbances in respiratory function.

Conditionally pathogenic and saprophytic fungi, which get into the air with soil dust and from plants, are encountered in towns and villages at varying frequency and concentration. The air is their temporary habitat. The presence of fungi in the air is connected with certain climatic and geographical conditions, with the period of maturation of pathogenic spores, and with their dispersion to various distances (up to several kilometres), especially by strong wind.

The concentration of fungi in the air of populated areas and housing varies, depending on the sanitary conditions, primarily the degree of dustiness. The maximum concentration of fungi is revealed in the air when the premises are cleaned under dry conditions. Saprophytic and conditionally pathogenic fungi are constantly found in housing, schools and hospitals; the most common of them are fungi of the genera *Aspergillus*, *Penicillium*, *Mucor*, *Cladosporium*, and *Fusarium*, and yeast-like fungi.

Dusty air, especially in damp, densely populated housing, contains diverse fungi, which predispose to respiratory sensitization manifested by various allergic diseases (including bronchial asthma).

Mycoses have been described among cattle-breeders, veterinarians, miners, the personnel of bathhouses, hairdressers', and vivaria. An illustrative investigation carried out in Czechoslovakia revealed the following.

For many years the mycologist Nevludova studied the ways of transmission of mycoses of the feet among miners of coalfields and workers in metallurgical plant.

The results demonstrated essential differences in the incidence of dermatophytoses in miners and metallurgical plant workers. The pathogenic species of mycoses also differed depending on the working and living conditions of the miners. Particular attention was focused on the dissemination of fungi in the sewage of shower-baths and on the footwear of miners. All this led to the incidence of mycoses until protective measures, such as disinfection and re-equipment of the shower-baths and improvements in their operating schedule, were taken. The morbidity rate markedly decreased as a result of the enhanced social and individual prevention and treatment of mycoses.

And there exists still another seemingly unexpected aspect of socially stipulated spread of fungal pathogens.

Taking into account the possibility for the fungi to inhabit the soil, scientists studied the conditions favouring the development of fungi outside the body. It turned out that some components of industrial waste, sewage, and garbage accumulate in the soil and form compounds that are readily assimilated by plants and microorganisms, particularly fungi.

Letuta analysed the influence of waste from the lead-zinc and titanium-magnesium industries on the growth of a pathogen of microsporosis caused by anthropophilic and zoophilic fungi. The increased survival period of cultures in the experimental medium as compared to these in the standard medium was established. In the soils of different towns the fungi behaved differently: in some places they lived long whereas in others they rapidly died off.

To a large extent this can be due to the effect of various components from chemical and other factories mixed with soil. In some cases such admixtures stimulate the growth of fungi, while in others they inhibit their development.

The original composition of soils (black earth, loam, sands, etc.) is also important because different soils may contain different microorganisms, including antagonists to pathogenic fungi.

The Clinical Course of Fungal Skin Diseases

Nina Sh., an eight-year-old girl, was admitted on 27 June 1983 to a paediatric mycological department of a Moscow hospital. The girl's cheerful look did not at all correspond to the gloomy appearance of her mother who was on the verge of despair over her daughter's illness. Some suspiciously threatening spots were on the child's skin. The girl's head had been shaved close to the skin but round bald patches and inflamed sites covered with crusts and scales were visible. What had happened?

It turned out that the girl dreamed for a long time about having a kitten. Her mother promised to buy a kitten as soon as school was over and, indeed, when the holidays began, she took her daughter to Ptichy rynok*, which is known to all Muscovites.

Every kind of animal and bird could be found here: puppies and guinea pigs, chickens and parrots, and many, many other animals! And there the touching muzzle of a green-eyed kitten peaked out from a basket. This was the one!

There was no end to joy... Nina played with the kitten for days and even let it hide under her blanket at night.

A week later Nina's mother noticed small

* Ptichy rynok is the market in Moscow where people buy and sell pets (*Tr.*).

red spots on her daughter's forearms, but she did not pay any special attention to them. Some skin irritation, she thought. After several days, however, similar spots appeared on the skin of the child's abdomen and thighs. The mother became anxious and immediately went to a local clinic for skin and venereal diseases where a diagnosis of microsporiasis of both the smooth skin and scalp was made.

At a local veterinary hospital affection of the kitten by microsporiasis was established; hence, the kitten was the source of infection for the girl.

Keratomycoses

Pityriasis versicolor (chromophytosis). The clinical manifestations of this disease are rather specific: yellowish-pink non-inflammatory maculae, which acquire a dark brownish tinge in larger lesions. They are located around the orifices of hair follicles, predominantly on the skin of the neck, chest, back, and abdomen. The various colour of lesions accounts for the name of the disease. The surface of lesions easily scales off, and because the scales resemble fine bran, the disease is also called dermatophytosis furfuracea. The disease often manifests itself in various ways on the scalp of children, but does not affect the hair. In other words, there exist a number of

obvious signs to diagnose pityriasis versicolor. Furthermore, in some cases the presence of infection can help diagnose some internal diseases because the foci can be located according to definite zones that are connected with certain internal organs by reflex.

This feature has long been known to physicians. Even before the X-ray apparatus was invented, the location of eruptions typical of pityriasis versicolor could make them suspect tuberculosis of the lungs. This was used, for example, for identifying tuberculosis patients among the young men called to military service. If the maculae were located in the subclavicular region, this could indicate active tuberculosis of the lungs in a recruit.

Thus, a tentative diagnosis was made 'from the threshold'. Usually the findings of percussion (variation in sound vibrations, depending on the nature of the underlying organs, while striking by a finger) or auscultation (listening) of the lungs confirmed the tentative diagnosis.

Sometimes, during visual examination of women, café au lait spots on the skin of the abdomen below the umbilicus indicate inflammation in the organs of the small pelvis (if other marked symptoms of diseases of the uterus or its appendages are absent).

The course of this disease is chronic and relapses often occur after apparent clinical recovery.

The infection is treated by rubbing keratolytic and fungicidal agents into the affected skin. Demyanovich's method is successfully used: a 60 per cent aqueous solution of sodium thiosulphate is rubbed first followed by a 6 per cent solution of hydrochloric acid (for 2-3 days). Rubbing of a 20 per cent benzyl benzoate solution for 2-3 days is also helpful. Ointments containing 3 per cent salicylic acid, or 5-10 per cent sulphur or tar, or a 3-5 per cent alcohol solution of resorcinol may also be used. It is recommended that courses of treatment be repeated in 2-3 months.

Erythrasma is a bacterial disease, which for a long time was considered to be a fungal disease, and by tradition is still regarded as belonging to the group of keratomycoses.

In addition to specific features of the body, increased perspiration and high ambient temperature are significant for the pathogenesis of the disease.

Erythrasma is most often localized in the inguinofemoral fold (as a rule, the skin of the scrotum is very rarely affected) and, more rarely, in the armpits and under the breasts. The primary lesions of erythrasma are commonly found in the interdigital folds of the feet.

The lesions, which are of a non-inflammatory character, consist of brownish or yellowish-red punctate maculae. On merging, they form large lesions with distinct, sometimes scalloped, contours. The surface of

the maculae is smooth or it may slightly scale. Subjective sensations are usually absent. Intertrigo, inflammation and itching may develop on the surface of the lesions in summer, especially when perspiration increases and hygienic rules are not observed.

The treatment of erythrasma is similar to that of pityriasis versicolor. Nowadays, a 5 per cent erythromycin ointment is successfully used. To prevent relapses, it is recommended to powder skin with preparations containing 8-10 per cent boric or tannic acids.

Trichomycosis nodosa (piedra nostras).

The name of the disease comes from the Spanish word 'piedra', which means stone.

Humans can acquire this disease through sharing the combs or hats of other people. A humid, warm climate and greasing the hair facilitate the development of this disease. The so-called white piedra affects the hair of the head, beard, and moustache, whereas the black piedra is found predominantly on the scalp.

The onset of the disease is marked by the appearance of very fine nodules on the hair. Their number varies from a single one to several dozens. The nodules are hard and have a spindle-like, oval or irregular shape; firm deposits may form a kind of muff around the hair. Only the hair shaft is affected. Although the causative agent penetrates under the cuticle, the cortical layer remains unaffected. The disease does not cause skin inflammation or brittleness of the hair.

To treat the disease, the head should be washed daily with a hot solution of corrosive sublimate (1 : 1000) or its vinegar. Shaving followed by washing with a hot soap solution leads to rapid recovery. White piedra is also encountered in this country but rarely. Black piedra occurs often in tropical countries.

Trichomycosis axillaris (trichonocardiosis) as well as erythrasma is conventionally included in the group of keratomycoses. The disease is marked by the appearance of yellow, or more rarely red and black, nodules on the axillary (very seldom pubic) hair. Inflammatory reaction of the skin is absent. The sweat of the affected areas may be stained yellow, red or even black. Soiled underwear is sometimes the first sign of the disease noticed by the patient.

Treatment consists in shaving the hair from the affected sites, rubbing of skin with 1-3 per cent salicylic alcohol or corrosive sublimate solution 1 : 1000.

Tinea imbricata (tropical ringworm) is a chronic mycosis of the superficial layers of the skin. Its lesions resemble fish scales.

The clinical picture of this disease is characterized by the dark-brown maculae that are oval or rounded in shape. Desquamation begins at the centre of a lesion where partial scaling of the horny layer takes place, while more intensively pigmented rim of scales in the form of a halo appears at the periphery. Then pigmentation and desquamation occur again at the

centre of the lesion. Numerous concentric scaling lesions of bizarre configuration are formed.

The disease progresses rapidly; the surface of almost all the patient's skin is involved except the scalp. The nail plates are also involved, which thicken and break easily. *Tinea imbricata* is accompanied by very intense itching, resulting in scratches complicated by attendant pyococcal flora. Inflammation is either not observed or very mildly pronounced.

The disease is treated by regular bathing followed by pumicing the affected parts of the skin; a 10 per cent chrysarobin ointment, which is considered the most effective agent, is then applied. Cases of effective griseofulvin therapy are reported.

Tinea imbricata occurs mainly in tropical countries (on the Pacific islands and coastal areas). In this country the infection has been described only among patients who have visited countries such as India, China, or Burma.

Dermatophytoses

Epidermophytosis

Only a few years ago a group of diseases caused by fungi of the genus *Epidermophyton* was regarded as epidermophytosis. The majority of mycologists in this country and

abroad, however, consider the main causative agent of epidermophytosis of the feet to belong to the genus *Trichophyton*, species *T. interdigitale*. Only one pathogenic fungus of the genus *Epidermophyton*, *E. floccosum*, inducing epidermophytosis cruris (ringworm of the groin), remains in the modern classifications of causative agents of fungal diseases.

Thus, the disease of the feet caused by *T. interdigitale* is only by tradition called epidermophytosis interdigitalis (ringworm of the toes).

Infection with epidermophytosis cruris occurs through improperly disinfected loofahs, linen, oilcloths, bedpans, and other things. Humans may also get infected as a result of direct contact with a sick person. Men are commonly affected.

The process usually manifests itself by symmetrical eruptions tending to peripheral growth and is localized in inguinal and other large folds (Fig. 2). The eruptions are inflammatory reddish-brown patches of rounded or irregular shape surrounded by a well-defined continuous fold, the surface of which is covered by vesicles, pustules, crusts, and scales. These slightly painful eruptions are attended by severe itching and, at times, burning. The onset of the disease is acute and, if not treated, the process becomes chronic lasting for an indefinitely long time with periodic exacerbations, especially during the hot season of the year and in strong perspiration.



Fig. 2. *Epidermophytosis cruris* affecting the skin of the armpit

During the acute period, in the absence of signs resembling eczema, the foci are treated with a 1-2 per cent iodine tincture for several days. Following this, dermatologists usually prescribe 3-5 per cent sulphur-tar ointments for 2-3 weeks.

After the patient has recovered, the skin areas of former lesions are for some time wiped daily (or every other day) with a 2 per cent iodine tincture for prophylaxis.

Epidermophytosis of the feet. Five clinical forms are differentiated: intertriginous, dyshidrotic, squamous, epidermophytosis of the nails, and acute epidermophytosis.

Intertriginous epidermophytosis is marked by the appearance of cracks in the interdigital skin folds, which are surrounded on the periphery by a whitish horny epidermic layer; weeping and scaling are characteristic. This is attended by itching of various intensity; pain sometimes develops. If the

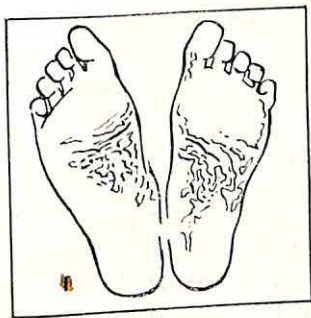


Fig. 3. Epidermophytosis of the feet

patient walks a lot and his footwear is uncomfortable, cracks in the interdigital folds may turn into erosions. Very often the process runs a sluggish course exacerbating during the warm season of the year.

Dyshidrotic epidermophytosis is manifested by the occurrence of a group of sago-like vesicles, localized in the region of the instep and on the toes. The vesicles have a thick horny cover. In some areas they may fuse to form multichambered blisters.

Collapsed vesicles and blisters form erosions (Fig. 3) that are encircled by a rim of horny layer detaching on the periphery. If pyogenic flora concurs, the contents of the vesicles (blisters) become cloudy and collapsed vesicles discharge pus. This form of epidermophytosis is accompanied by itching and sometimes pain.

Squamous epidermophytosis is characterized by mild scaling in the arches of the

feet on slightly hyperaemic skin. Scaling may occur on large skin surfaces of the soles or be limited to its small areas. In comparison with other forms of epidermophytosis, this form is mildest and is often unnoticed by the patient, who does not experience any unpleasant sensations, except for slight and transient itching. Such patients, therefore, rarely seek doctor's advice and continue to attend bathhouses, saunas, swimming pools, and beaches, becoming carriers of epidermophytosis of the feet among healthy people.

Epidermophytosis of the nail (onychomycosis). The fingernails are never involved in this process, but the nail plates of the toes are affected in approximately 20-30 per cent of the patients with epidermophytosis. The free edge of a nail is affected first. The nail plate thickens, acquires a yellow or ochre-yellow tint, and becomes friable and brittle with horny masses accumulating under it (hyperkeratosis subungualis). The free edge of a nail thickens and becomes uneven, as if it were eaten away. The nail plates of the first and fifth toes are usually involved in the pathological process. This selective affection is to a certain extent due to the frequent injury caused by footwear.

Acute epidermophytosis develops as a result of acute exacerbation of dyshidrotic or, more rarely, intertriginous forms of the disease. The disease manifests itself by vesiculo-bullous eruptions occurring in abun-

dance on the soles and toes; the skin of the toes becomes swollen and oedematous. The eruptions are usually bilateral and accompanied by elevation of body temperature, general indisposition and headache, inguinal lymphadenitis, and secondary generalized allergic eruptions, i.e. epidermophytids.

Epidermophytids are secondary allergic reactions, which may develop even in uneventful intertriginous and squamous forms of epidermophytosis due to a pronounced hyperergic state of the body induced by strong allergic properties of the causative agent.

The irritation of primary lesions or internal administration of biologically active drugs is considered to be the cause of secondary eruptions. Epidermophytids often occur on the palms and fingers in patients with heightened body reactivity. As a rule, in such cases, the fungal infection is not revealed, i.e. epidermophytids are considered toxico-allergic affections.

Rubromycosis

Trichophyton rubrum is now considered by many scientists to be the causative agent of rubromycosis.

The fungus affects the skin folds and smooth skin of the body and extremities, along with the interdigital folds of the feet and hands and the nails of the toes and fingers. Frequently, the downy hair is also involved

in a pathological process in generalized forms of rubromycosis; the long hair of the head and other areas is affected more rarely.

The disease has long been endemic in the Far East and South-East Asia (Japan, China, India, etc.). After World War II, however, the rapid spread of the disease in Europe and the United States alarmed the physicians.

It should be noted that in many countries, including the USSR, the incidence of generalized forms of rubromycosis also grew, constituting up to 15-20 per cent and more of the patients suffering from rubromycosis of the feet and hands.

The disease has the following clinical forms: (1) rubromycosis of the feet; (2) rubromycosis of the feet and hands; (3) generalized rubromycosis.

Rubromycosis of the feet. This localization of mycosis is the most common. Beginning with the interdigital folds of the feet, the process gradually involves the soles and nail plates. As distinct from epidermophytosis, all, or almost all, interdigital folds are affected in rubromycosis and many or all nail plates. There are three types of affection of nail plates: (1) normotrophic; (2) hypertrophic (Fig. 4); and (3) atrophic.

In the first type of rubromycosis, the lateral or free edges of a nail plate are affected, which is manifested by white or yellowish streaks. In the second type, the nail plate thickens due to subungual hyperkeratosis. The nail plate lacks lustre, and its free edge

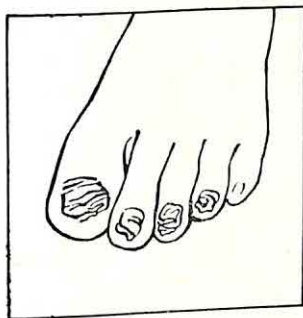


Fig. 4. Rubromycosis of the nail plates of toes, hypertrophic form

crumbles. In the third type of rubromycosis, the larger part of the nail plate thins and then collapses, being preserved only partially near the nail fold. The nail plate may even separate from the nail bed.

As distinct from epidermophytosis, the back and lateral surfaces of the feet and toes are also involved. Affection of the feet is often attended by severe itching. The vesicular eruptions are rare in adults and occur usually in the initial stages of the disease.

Rubromycosis of the feet and hands. Fungal affection of the skin and nail plates of the hands is usually preceded by a more or less prolonged pathological process affecting the feet. The isolated localization of rubromycosis on the hands is a rare phenomenon, taking place only when the causative agent initially invades the skin of the hands (Fig. 5).

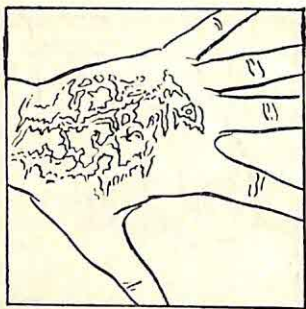


Fig. 5. Rubromycosis of the hand

The clinical signs of rubromycosis on the hands hardly differ from those on the feet. True, affection of the skin in the interdigital folds of hands and on the palms may be significantly less pronounced as a result of repeated washing during the day.

Generalized rubromycosis. Manifestations of this disease attended by deep destruction of tissues of the smooth skin develop after a prolonged (from several months to 5-10 years and longer) process caused by fungi usually in the presence of pathology of the internal organs, endocrine and nervous systems, or trophic skin lesions. Long-term treatment with antibiotics, or cytostatic and steroid preparations is often conducive to the development of generalized rubromycosis.

The disease may also run without the formation of deeply located lesions. In such cases the clinical manifestations very

closely resemble those in eczema, neurodermitis, and psoriasis. Exudative lesions may also appear in approximately 5-7 per cent of the total number of patients with rubromycosis in the form of small vesicular eruptions and crusts on the feet, hands, and other skin areas.

It should be mentioned that some patients may have secondary (allergic) eruptions on the body and extremities when rubromycosis is manifested by exudation.

Large folds of the body (on the buttocks and between them, inguinofemoral, under the breasts) are usually attacked after a more or less prolonged existence of mycotic lesions on the feet and hands. The lesions originate from the depths of large folds, involving the inner surfaces of the buttocks and then spreading to the outer surfaces. The surfaces of the lesions are yellowish-red or brown, they are mildly infiltrated and scaling. The edges of the lesions are slightly elevated, have an interrupted scalloped fold consisting of small vesicles and crusts.

Trichophytosis

The name of the disease originates from the Greek words *thrix* hair and *phyton* plant. Trichophytosis is the infection of the hair with fungi that are known to be referred to plants. Microsporosis, which is discussed below, and trichophytosis were formerly called *Trichophyton tonsurans* (bald ring-

worm). However, the clinical course, epidemiology, and causative agents of these diseases differ.

Trichophytosis is caused by different fungal species, such as anthropophilic fungi, whose main host is man, and zoophilic fungi, which prefer parasitizing on animals.

The anthropophilic fungi *Trichophyton tonsurans* and *Trichophyton violaceum*, the causative agents of trichophytosis in man, are rather widely spread. *Trichophyton verrucosum* and *Trichophyton gypsum* are typical causative agents of trichophytosis in animals. There are other, though more rarely encountered, fungi of the genus *Trichophyton*.

The subdivision of trichophytosis into trichophytosis caused by anthropophilic fungi and trichophytosis caused by zoophilic fungi is largely significant for elaborating practical epidemic control measures.

Trichophytosis in Man

Several clinical variants of trichophytosis in man are distinguished.

Superficial trichophytosis of the scalp. Children of school age are most susceptible to this disease. Superficial trichophytosis was formerly considered to be a 'school' infection and the main epidemic control measures were conducted at children's establishments (nurseries, kindergarten, school). It has now been proved necessary to carry out basic epidemic control measures

both at children's establishments and in the family of a sick child. The source of infection is often found at home. It has been established that approximately one-third of all children with documented cases of superficial trichophytosis get infected by adults. Thus, superficial trichophytosis is still often said to be a 'family' infection.

Small-lesion and large-lesion forms of superficial trichophytosis may develop on the scalp. The lesions are characterized by uneven, blurred contours and are mildly inflamed; they have an irregular rounded shape and are covered by whitish scales. The fact that the hair is not completely affected in the lesions but becomes thin, as it were, helps the physician to diagnose superficial trichophytosis of the scalp. Vesicles, pustules, and crusts are sometimes formed on the periphery of a lesion.

It is quite characteristic of the disease that the affected hair breaks off very short (1-2 mm from the scalp surface) while the extracted fragments look like commas, hooks or question marks. This type of hair is often called 'stumps'. The hair breaks off at the level of the smooth skin ('black dots') somewhat rarer, and especially in children.

Superficial trichophytosis of smooth skin.
The lesions may occur on any, but more often on exposed, skin areas, i.e. the face, neck, forearms, and also on the trunk. As distinct from superficial trichophytosis of the scalp, the skin lesions are well outlined,

have rounded or oval contours, and are slightly elevated above the adjacent intact skin.

This form of trichophytosis follows an acute course, and, if adequately treated, the lesions usually heal within a few days.

Trichophytosis of the nails. As a rule, the nail plates (more commonly of fingers) are affected in chronic trichophytosis in adults and very rarely in children when the course of mycosis is prolonged. The process begins in the free edge of a nail plate, which then loses its characteristic lustre. Greyish-dirty lesions form in the thickness of the nail. Gradually the affected nail plates become tuberculous, easily crumble, and the free edge of the nail plate elevates due to its splitting into several layers. Later, if not treated, the nail turns into a shapeless brownish-black mass. A few nail plates or even all of them are usually affected. The process lasts for months and years in the absence of treatment.

Chronic Trichophytosis in Man

By the time of maturation, the majority of young males spontaneously recover from chronic trichophytosis of the scalp and smooth skin, which is associated with endocrine changes in the body. Females, however, continue to be sick for many years, or even decades.

It should be noted that in some patients, already in childhood, the disease may be

manifested by signs typical for chronic trichophytosis.

The disease often develops during dysfunction of various organs and systems of the body, for instance, the vegetative nervous system and endocrine system (impaired function of sexual glands), in hypovitaminosis, particularly vitamin A deficiency. The disease may become chronic from its onset.

Most often women suffer from chronic trichophytosis (80 per cent of cases). The pathological process is mainly localized in the occipital or temporal regions, to which a physician should pay particular attention during examination. Diffuse, or small lesion scaling may be observed, the former resembling seborrhoea squamosa of the scalp. Atrophic patches of alopecia may develop when the course of the infection is prolonged (Fig. 6). Hair that breaks at the level of



Fig. 6. Chronic trichophytosis caused by anthropophilic fungi

the scalp is the most typical feature of this form of trichophytosis. As was mentioned above, the hairs are called 'black dots'.

The pathological process may localize on the skin of the shins and knee joints, buttocks, and forearms, and more rarely on the face and torso. The lesions are often cyanotic, have indistinct margins, and look like scaly maculae. Vesicles and crusts on the periphery of lesions are not observed.

A protracted and flaccid course of chronic trichophytosis can be conditioned by an anergic immunological state of the body. This, in particular, may also account for the negative trichophytin tests and the absence of allergic eruptions.

Patients suffering from chronic trichophytosis for many years are the main source of infection for children, who in such cases develop superficial trichophytosis.

The adults affected by chronic trichophytosis constitute not less than one-third of all cases with trichophytosis of the scalp. Therefore, when superficial trichophytosis is diagnosed in a child, the physicians pay special attention to the adults in the family of a sick child, because most probably he or she has been infected at home. The child's contacts in kindergarten, school, and other institutions are also examined.

The pathogenesis of chronic trichophytosis is rather complicated, and the disease is difficult to diagnose. Treatment also presents considerable difficulties because

antibiotics (griseofulvin) and stimulators of the general and immunological reactivity of the body and sometimes hormonal preparations are needed.

Trichophytosis in Animals

The main clinical feature that distinguishes trichophytosis in animals from that in man is a considerably more marked inflammation that often runs a vigorous course and develops in patients infected with zoophilic fungi, i.e. *T. gypsum* and *T. verrucosum* mentioned above.

The main hosts of *T. gypsum* are mice (including laboratory), rats, and other rodents. It has been proved that guinea pigs, rabbits, foxes, and hedgehogs are affected by this type of infection. Mice may contaminate hay, straw, bedding, and soil in stables and cow-sheds. As a result, the disease attacks cows, calves, and more rarely, horses, which are the carriers of *T. verrucosum*. Recently this disease has also been registered among sheep.

The epidemiology of superficial trichophytosis caused by anthropophilic fungi, i.e. *T. violaceum* and *T. tonsurans*, is well known, but this is not the case with the epidemiology of trichophytosis in animals.

In a number of regions in this country this type of the disease predominates over all other dermatophytoses. Previously, the main causative agent of trichophytosis was *T. verrucosum*, but recently it has been

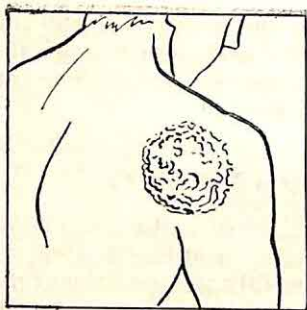


Fig. 7. Superficial zoonotic trichophytosis

replaced by *T. gypsum* in many regions.

Animal carriers of mycoses are important in the epidemiology of trichophytosis caused by zoophilic fungi. Thus, in the suburbs of Moscow, the carriers of *T. gypsum* are often field and wood mice, meadow and bank voles, and common shrews. There is evidence that insects may also transmit the fungus infection.

Dermatophytes may parasitize for some time on the straw and corn stalks, from which animals and people may get infected.

Trichophytosis in animals is clinically subdivided into three forms: superficial, infiltrative, and suppurative. The lesions are more often found on exposed skin areas, they have a tendency to fuse and form large skin lesions with festoon contours. This is particularly characteristic of the disease caused by *T. verrucosum* (Fig. 7), whose carrier, as mentioned above, is cattle.

This fungus commonly penetrates the skin around the mouth or eyes, which reddens and desquamates. On the periphery of a lesion, a marked fold is formed consisting of vesicles, nodules, and crusts. The clinical picture of superficial trichophytosis in animals is very similar to that of superficial trichophytosis in man; therefore, only the use of methods of cultural diagnostics, i.e. the cultivation of scales, crusts, and downy hair from skin lesions on a nutrient medium, can help to make a correct diagnosis. This has epidemiological significance because it determines the appropriate preventive measures.

Infiltrative trichophytosis in animals can develop independently or be intermediate between the superficial and suppurative (deep) forms. The sites of inflammation are elevated above the intact skin, and the adjacent lymph nodes are enlarged. The process intensifies, and the disease transforms into a suppurative form if treatment is not carried out in due time.

Suppurative trichophytosis has a typical clinical picture. Isolated, large pustules are formed, which are well outlined, hyperaemic, and covered by many purulent crusts. Careful examination allows a physician to conclude that the lesion consists of a large number of small abscesses although the first impression is that the patient has a single, large and deep abscess.

The pus that is discharged from each hair follicle resembles honey in combs;

hence, the disease is called Celsus' kerion (Gk *kerion* honeycomb), named after the physician who first described the lesion. When localized on smooth skin, more frequently on exposed parts, suppurative trichophytosis runs a less acute course.

The pus from a pustule can lyse (dissolve) the fungi; therefore, the patient is prone to spontaneous recovery, after which scars remain at the site of the pathological process. The treatment is aimed, on the one hand, at arresting the further spread of infection and, on the other, at preventing the development of suppuration, which usually leaves rough and ugly scars on the skin.

How can one explain these specific features of the process? One of the possible reasons is the decreased reactivity of the patient's body, which does not react in time to the penetration and activity of the fungus (foreign protein).

In some animals (cows, calves) the process caused by the fungi follows a chronic course. In cats the disease may be asymptomatic. As a rule, the fungi induce a vigorous reaction of the body when they get onto the skin of a human being. However, if the person catches the infection from a sick person and not directly from a sick animal, the reaction will be less pronounced.

How do humans acquire the infection?

In the vast majority of cases (70-90 per cent) humans become infected with *T. tonsurans* (bald ringworm) through direct contact with animals or through objects con-

taminated by them. In addition, a patient suffering from trichophytosis caused by zoophilic fungi may also be a source of infection for other people.

Infection can occur through direct contact with sick individuals as well as through their belongings.

Persons living in rural areas, particularly those who take care of sick animals, members of their families, and also the owners of animals affected by bald ringworm are attacked by trichophytosis caused by *T. verrucosum*.

Workers in storehouses, elevators, and farms, and those engaged in the storage and keeping of grain or in forage transportation are commonly affected by *T. gypsum*. Most commonly they are infected with this fungus through various objects that were in contact with sick rodents.

To prevent the spread of trichophytosis caused by *T. gypsum*, it is recommended that agricultural workers involved in hay transportation from stacks or in grain loading should wash with soap and change their linen immediately after work. The outer clothing should be thoroughly cleaned.

Sporadic cases of trichophytosis are observed among workers of vivaria, the source of infection being laboratory animals. For this reason, all personnel working with animals should be given regular checkups and instructed about preventive measures. Sick animals must be destroyed, and the

complex of epizootic control measures should then be carried out.

Cattle-breeders and veterinarians play an important role in preventing the spread of trichophytosis among animals because calves and other animals may disseminate the bald ringworm. Calfmaids, for instance, should know that ringworm is harmful not only for animals, i.e. it hinders their development, but can also be a source of infection for human beings (other stock-breeders and their family members).

Calfmaids are the first to discover the ringworm and they may and must prevent its spread by reporting it to veterinarians. The number of sick animals increases in January. The incidence of the disease is low from May to July and increases from September on. This is explained by keeping the animals in stalls, which results in their more frequent contacts.

The seasonal character of morbidity among animals should be taken into account when organizing preventive measures.

Microsporosis

Like trichophytosis, microsporosis is also divided into that occurring in man and animals.

Microsporosis in man is caused by *Microsporum audouinii* (not being registered in this country for about 40 years!) and very contagious *Microsporum ferrugineum*, which is encountered in some regions

of Kazakhstan and republics of Central Asia and the Transcaucasia.

Microsporum canis (*M. lanosum*) and very rarely encountered *Microsporum distortum* are zoophilic fungi. In this country, the main hosts of the first type of zoophilic microsporon are cats. People, especially children, more often become infected by kittens with whom contact is more readily achieved due to their playful nature. It is interesting that in a vast majority of cases in Western Europe humans get infected from dogs, in spite of the fact that 'cat's livestock' is sufficiently great in number.

It should also be mentioned that the epidemiology of microsporosis in man has been well studied but the epidemiology of microsporosis in animals is still obscure. This problem was thoroughly investigated at the Central Research Institute of Skin and Venereal Diseases of the USSR Ministry of Health, the Research Institute of Skin and Venereal Diseases in Kazakhstan, and other establishments concerned with medical mycology. The sources of infection with zoophilic fungi were studied for a number of years.

It turned out that about 80 per cent of the patients caught the infection from cats (usually kittens) and dogs (rarely), and about 3-5 per cent, from sick individuals. The source of infection was not revealed in approximately 15 per cent of the patients.

Consequently, there are still 'white spots' in the epidemiology of this mycosis. To eliminate them, the intense collaborative work of mycologists and personnel of veterinary service lies ahead.

It was also revealed that dermatophytes that cause microsporosis in animals can remain for up to 6 months on the surface of soil, in the sand of sandboxes, and on other objects in the external environment. For all this time they can be a source of infection for humans.

During World War II large outbreaks of microsporosis brought about by *Microsporum ferrugineum* were registered in this country. Today, the number of patients with this form of microsporosis has significantly decreased. However, when the infection makes its appearance at children's institutions, it spreads rather quickly among the children and their families.

Microsporosis of the scalp caused by *M. ferrugineum* is often very similar to superficial trichophytosis of the scalp, however, in superficial trichophytosis of the scalp in man the lesions usually do not tend to fuse, no matter how many of them the patient has. In microsporosis of the scalp the lesions of *Microsporum ferrugineum* have a marked tendency to fuse, distinguishing microsporosis from other fungal infections of the scalp. Zones of smooth skin near the scalp are the favoured localization of microsporosis.

Both the skin and the scalp may be in-

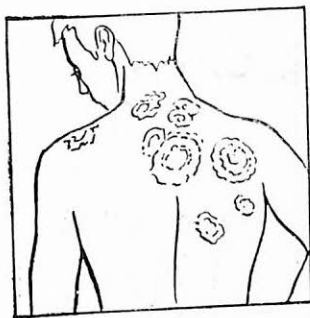


Fig. 8. Microsporiasis caused by anthropophilic fungi

involved in the pathological process. On fusing, the foci have intricate shapes; in many patients they look like rings, one ring being inside the other (Fig. 8).

At present, the incidence of microsporiasis caused by zoophilic fungi is much greater than that of microsporiasis caused by anthropophilic fungi. In addition, the former type of microsporiasis is the most commonly encountered fungal infection affecting both the smooth skin and the scalp (between 52 and 73 per cent and over).

Isolated and large lesions covered with whitish scales are typical of microsporiasis caused by zoophilic fungi; the lesions are rounded or oval in shape (as if being stamped) with sharply outlined contours. Small lesions are very often found on the periphery of large ones; inflammation is usually mild. Infiltrative and suppurative forms are rarely encountered; the nail plates of



Fig. 9. Microsporiasis caused by zoophilic fungi

fingers are involved in a pathological process still rarer.

In superficial trichophytosis of the scalp the hair as if thins, while in microsporiasis caused by zoophilic fungi usually all the hair in a lesion is affected, breaking high (5-8 mm) above the skin level. The white thin sheath may be seen at the base of the affected hair: these are the fungal spores, which surround the hair like a muff.

In this type of microsporiasis the lesions of smooth skin (Fig. 9) are clinically very similar to those in superficial trichophytosis of the same localization. However, there is greater number of lesions in microsporiasis and they follow more acute course. The downy hair is involved in the pathological process in more than half of all the cases with microsporiasis.

The main source of infection in microsporiasis caused by zoophilic fungi are cats, especially kittens. Therefore, the indication

of contact with them in the patient's case history helps to diagnose the disease. Cases of affection of many family members are not rare.

Favus

By the end of 1983 only a few patients affected by favus were registered in this country. The disease became history.

Only a few decades ago favus was frequently encountered, particularly in the hardly accessible mountainous regions of the Transcaucasia and republics of Central Asia. Patients, especially women, tried hard to conceal the manifestations of this disease. There were amusing incidents when after a few years of married life the husband discovered that the crown of his wife's head was almost hairless. A rim of hair remained only on the periphery, with which the wife could skilfully cover the bald top of her head.

Favus has been known since ancient times. The disease was widely spread in pre-revolutionary Russia. After the revolution the morbidity rate decreased drastically, and at present the mass incidence of favus has been eliminated in this country. Sporadic cases of favus occur rarely in the central part of the USSR; the clinical signs of the disease are atypical, which makes difficult its timely detection.

The improved well-being and cultural level of the population, regular checkups

for dermatophytoses, free qualified medical aid, health education on a wide scale, and other measures contributed to the successful elimination of the mass incidence of favus in this country.

The causative agent of favus in humans is *Trichophyton schoenleinii*, named after the author who first described it in 1839.

The anthropophilic fungus that causes favus parasitizes on human skin or its appendages. Cases of visceral affection by this fungus are described. Man is rarely infected with favus by other fungi.

The diagnosis of favus in typical cases is not difficult. Ochre-yellow resembling a turned-over saucer crusts indented in the centre (scutula); skin atrophy or scars; a thin margin of healthy hair by the periphery of the scalp (if the whole head is affected); the 'mouse' or 'barn' smell from the patient's head, and specific affection of the hair allow one to diagnose favus by the clinical picture alone.

Atypical forms of favus are much more difficult to diagnose. The squamous form of favus of the scalp is characterized by rather abundant scaling that resembles clearly marked seborrhoea; its impetiginous form manifests itself by purulent crusts simulating eczema complicated by suppuration.

The affection of hair is characteristic of these two atypical forms of favus as well as of the first form. The hair becomes dull and grey as if covered with dust; it lacks lustre, never breaks, and resembles a wig or

tow. Impetiginous forms of favus are rather frequently encountered. Squamous and scutular forms of favus of the smooth skin are more rarely observed.

Gradual involvement of the nail plates into the pathological process is typical of favus. A brown or dirty-grey spot appears, most often in the centre of the nail plate; it remains fixed for a long time and then, gradually widening occupies the whole nail plate. Only the nail plates of fingers are affected. The destructive changes of the nail plates in favus are considerably less pronounced compared to other fungal affections.

Mycoses of the Feet and Their Prevention

The concept 'mycoses of the feet' includes widely spread diseases caused by fungi of the genus *Trichophyton* or *Epidermophyton* and yeast-like fungi of the genus *Candida*. Persons of any age or sex, including children, may become infected with these diseases. In a number of countries up to 80 per cent of the population are affected. The infection is most frequently registered among the workers of industrial enterprises, building sites, bathhouses, showers, and laundries.

The difficulty of decreasing the incidence of mycoses of the feet is connected with wide spread of the infection and the great variety of its clinical forms (from sub-

clinical, hardly noticeable to acute exudative, generalized affections when the hands and other skin areas become involved).

The pathogens of the disease are highly resistant to disinfecting agents; this makes them viable and pathogenic for a long time in the scales of skin and fragments of nails that are shed from the affected lesion. This also presents a constant threat of infection and reinfection among the population.

Sometimes patients do not believe that recovery is possible, and this may occasionally account for their delayed visit to a doctor. Patients should know that mycoses of the feet are curable but must be treated thoroughly and for a long time under a physician's control, otherwise they may become chronic. When the treatment is inadequate, exacerbations may follow, which will necessitate repeated courses of treatment. It is necessary to understand the importance of treatment for the patient's own welfare and for preventing the spread of the infection; thus, 'bilateral patience' of both the patient and the physician is needed.

The violation of the rules of hygiene, particularly while visiting a shower, bathhouse and swimming pool, or when sharing shoes, socks, stockings, the same bed, scissors (pliers) for cutting nails may lead to mycoses of the feet.

Humans become infected through close contact with a sick person and also through

objects contaminated by pathogenic fungi that belong to the patient (footwear, linen, loofahs, socks, stockings). The skin of the interdigital folds and soles is often the entry for infection.

The penetration of fungi into the horny layer of the skin, the thickness of the epidermis, or even the derma, is facilitated by impaired intactness of the skin, i.e. cracks, or sores resulting from rubbing of shoes that are worn for a long time, occasionally for many days, without change. Minor injuries to the skin of the feet, hyperhidrosis, intertrigo, and other factors are also significant.

The development of the disease also depends on the state of the immunological body's reactivity: the threat of mycoses incidence increases when it is decreased because of alimentary vitamin deficiency, long-term unvarying diets, and frequent violation of personal and social hygienic rules.

Thus, mycoses of the feet are contagious diseases. A patient is the source of infection, and the causative agent is transmitted through contaminated objects that belong to him.

The causative agents of mycoses of the feet are resistant to the external environment, and their favoured sites are the scales of the skin and nails. They hardly react to desiccation, and soap solutions are not effective at all. Ethyl alcohol (96 per cent) destroys the fungi only after many hours of

exposure. The fungi can remain viable for a long time on moist floor mats, on the surfaces of wooden benches and gratings, on floors, and in sewage, loofahs, insoles, linen, combs, and brushes.

In the family, where contact with the things belonging to a sick child or to one of the parents is almost unavoidable, the infection is possible through shared clothes, socks, stockings, shoes, loofahs, pumice stones, and sponges.

Children may also be infected at children's institutions if the personnel suffer from fungal diseases and do not take measures of precaution.

As has already been mentioned, the clinical manifestations of mycoses vary. The disease begins with scaling and vesicular eruption, symptoms that hardly trouble the patient. This is important from the epidemiological point of view because it leads to a relatively protracted period of an uncontrolled course of the disease and contributes to the spread of infection.

Laboratory tests are obligatory to verify the diagnosis though definite clinical signs are observed, particularly typical localization of the infection (the third and fourth interdigital folds of the foot, the nail plates of the big and little toes). The laboratory investigation consists of microscopic examination of pathological material and culturing of fungus on nutrient media.

The **treatment** is prolonged and combined, including non-specific and specific therapy,

particularly long-term application of the antifungal antibiotic griseofulvin and external application of various fungicidal keratolytic agents to shed the epidermis.

Control of mycoses of the feet envisages the effect on all links of the epidemic chain. Detecting and treating patients, who are the source of infection in families, at enterprises and children's institutions, is one of the most important and primary preventive measures.

Regular medical checkups of definite population groups are of great significance. The most susceptible to mycoses of the feet are bathhouse attendants, sportsmen, workers of heat-treatment shops, and other groups of persons dealing with constant reservoirs of the causative agents of mycoses (showers, laundries, etc.). The foci of infection, such as the patient's place of residence and work, are examined for early detection of patients.

Concrete preventive measures depend on specific features of labour at an enterprise.

Personal prophylaxis is of great significance in mycoses of the feet, therefore, children should be taught hygienic habits from early childhood. Children must know that they should not use someone else's shoes, socks, stockings, gloves, and mittens. Treatment of hyperhidrosis of the feet should be carried out, particularly during the spring and summer months: more frequent washing of the feet and regular

changing of socks and stockings is recommended and, if necessary, the use of powders containing urotropin, salicylic acid (2-3 per cent), or zinc oxide, tannin (1-2 per cent), or boric acid (2-3 per cent).

In order to prevent fungal diseases of the feet, the following hygienic requirements must be met: a washbasin and bench in a bathhouse should be rinsed with boiling water and one's own shoes must be worn in a shower, swimming pool, etc. After washing, the feet should be wiped dry with a towel and the soles and interdigital folds rubbed with cotton wool wetted in diluted table vinegar.

Persons suffering from mycoses of the feet and hyperhidrosis are not recommended to wear nylon socks, stockings, and rubber shoes because they are not hygroscopic. Socks (stockings) must be changed daily. Hyperhidrosis should be treated according to the physician's recommendations. Spongy rugs should not be used in baths (showers) because they can accumulate scales infected with fungi. The bathtub should be washed with soap (washing powder) and rinsed with hot water. Socks, stockings, and footwear must not be shared because they may contain scales contaminated by pathogenic fungi.

Shoes can be disinfected at home: the insole and inner surface of shoes should be wiped with a cotton wool abundantly wetted with a 25 per cent formalin solution (formalin to water as 1 : 3) or a 40 per

cent solution of acetic acid. They should then be placed into a polythene bag or wrapped tightly in paper for 2 hours; after airing for 24 hours the shoes can be worn. The stockings, socks, bed linen and nursing materials of patients should be disinfected by 10 minutes' boiling.

The patient must visit a physician immediately after the first clinical signs of the disease have appeared; this is important for the timely treatment and prevention of infection.

We should like to mention once more that the infection is transmitted through objects belonging to patients with mycoses of the feet (footwear, socks, stockings, gloves, linen, scissors for cutting nails, washbasins, loofahs), and through objects in general use in bathrooms, showers, bathhouses, and swimming pools (benches, cloth and rubber rugs, wooden gratings, tools used for manicure and pedicure, etc.); therefore, disinfection is important. It should be borne in mind that the infection is also transmitted by touching the floor surface in bathrooms, bathhouses, and swimming pools.

The living conditions and organization of preventive measures in the family play an important role in the prophylaxis of mycoses of the feet.

Bed, linen, towels (separate one for feet), loofah, washbasin, scissors, stockings, socks (not nylon!), shoes, etc. must be strictly individual for the patient, who is recommended to have a separate place for keeping

the footwear. The dirty linen, stockings, socks, and gloves of the patient are collected into a special sac and disinfected by 10 minutes' boiling in a 1-2 per cent soap-soda solution. Linen can also be disinfected by soaking in disinfecting solutions, such as 4 per cent lysol (for 30 minutes) or 5 per cent chloramine (for 1 hour) and other solutions.

This also applies to the disinfection of cotton stockings, socks, and gloves. Nylon socks and stockings are disinfected by 10 minutes' boiling or soaking in a 10 per cent formaldehyde solution for 15 minutes.

A bathtub can be disinfected with 5 per cent lysol or 5 per cent chloramine solutions, or with a 1 per cent solution of a water-soap emulsion of 1-chlorbetanaphthol. These solutions are poured over the bathtub bottom (for 10 min), and the surfaces of the sides of the bathtub are wiped with them. The bathtub is then thoroughly rinsed with hot water and a loofah or rag. Washbasins are disinfected in the same way. Loofahs, sponges, and brushes are boiled for 10 minutes or treated with disinfecting solutions in a similar way as linen.

The floor of the premises is irrigated with a 1 per cent solution of bleaching powder, 5 per cent solutions of chloramine or lysol, or some other disinfecting solutions. Thorough cleaning of the premises is carried out in 1 hour. The floor may be abundantly washed with hot water from a hose at high pressure (1.5-2 atm). This treatment can, of

course, be carried out in premises with ceramic (tile) or cement floors.

The bath slippers are boiled for 10 min in a 1-2 per cent soap-soda solution or placed (for 30 min) in a 10 per cent formaldehyde, a 5 per cent chloramine or lysol solution, or in a 1 per cent solution of bleaching powder. Wooden or rubber shoes are then rinsed with water and dried.

At beauty salons, clients with visible changes of the skin or the nails of the toes and fingers are not serviced without a certificate from a dermatologist.

Manicurists and podiatrists are required to have an extra set of tools so that they can be disinfected in turn; the use of only the disinfected set for clients is compulsory.

Overalls, towels, and napkins that have been used by personnel while working with clients are boiled or soaked in one of the disinfecting solutions.

Advice to Patients with Mycoses of the Feet

A patient with fungal affection of the feet must undergo thorough treatment and follow all the physician's recommendations without fail, otherwise complications may develop. In addition, the health of those surrounding him—relatives and close friends—depends on this.

Mycoses of the feet are contagious diseases caused by fungi. The causative agents are exceptionally viable and resistant to the

effect of various physical and chemical agents. Fungi penetrate mainly the skin of the feet and nails of the toes, thus causing their affection.

The disease follows a long course, slowly responds to treatment, and requires strict fulfillment by the patient of all the physician's recommendations. The initial manifestations of mycosis must be treated, but self-treatment and home remedies that are very harmful must in no circumstances be used.

The former lesions should be painted with a 2 per cent iodine tincture for prophylactic purposes 2-3 weeks after recovery. All members of the family must undergo prophylactic examination.

It is very important for the family of the patient to observe the following hygienic rules:

1. The patient should observe the rules of personal hygiene (keep the skin clean, change stockings and socks daily, dry the skin thoroughly after washing, particularly in the interdigital folds, using a separate towel).

2. In hyperhidrosis of the feet, treatment with formidron, 3-5 per cent water solution of formalin, and 2 per cent salicylic or boric alcohol for 5-6 days is recommended. Control of hyperhidrosis of the feet contributes to the prevention of relapses and reinfection.

3. The patient should have his own linen, footwear, stockings, socks, gloves, loofah,

scissors for cutting nails, etc; his belongings and bed linen should be boiled in a soap-soda solution for 15 min before washing.

Shoes should be disinfected 1-2 times a month as follows. The inside of the shoes should be thoroughly wiped with cotton wool or a gauze ball wetted in a 10 per cent solution of formaldehyde (25 g of 40 per cent formaldehyde added to 75 ml of water). The shoes should then be wrapped in thick paper or oil-cloth; in 24 hours they should be dried well and aired. Regular disinfection of the patient's belongings prevents reinfection and relapses of the disease.

A Few Words about the Control of Dermatophytoses

Regular medical checkups of the population that have been worked out and proven effective in this country underlie the control of trichophytosis, microsporosis, and favus. In particular, this made it possible to practically eliminate favus and to achieve a gradual decrease in the incidence of other dermatophytoses.

The method for controlling dermatophytoses implies a complex of measures, of which the main ones are listed below:

1. All patients with trichophytosis, microsporosis, or favus are registered in a spe-

cial form that is subsequently transferred to a sanitary-epidemiological facility and higher-standing institutions for skin and venereal diseases. The form is approved by the USSR Ministry of Health and Central Statistical Board.

Having been informed about a fungal infection detected at a children's institution or in a family, the epidemiological facility carries out the appropriate disinfection.

Moreover, when patients with diseases caused by zoophilic fungi are detected, the veterinary and municipal services have many tasks to accomplish in the area of infection, namely, rodent control, treatment of domestic cattle, and the search for sick and stray animals (cats and dogs).

2. Examinations of children and the attending personnel at schools and other children's institutions are conducted by physicians or medical nurses in schools, kindergartens, and nurseries, and are supervised by the medical personnel of a clinic for skin and venereal diseases.

3. Early, effective, and free treatment is available for all patients with dermatophytoses. This is an important achievement in the system of regular medical checkups of the population. The treatment should, as a rule, be conducted under in-patient conditions and after two or three tests with negative results continued under out-patient conditions, but strict observations of the physician's recommendations should be thoroughly checked.

4. The sources of infection are identified as soon as possible. This is sometimes a difficult task because the transmission of the infection is mediated, i.e. it is transmitted through various objects. For instance, anamnestic data indicating the source of infection are not always obtainable when treating patients with trichophytosis caused by zoophilic fungi.

5. Examination of all members of the patient's family within as short a period of time as possible is undertaken, and any sick members are treated.

6. Health education, especially among schoolchildren, their parents, and the personnel of children's institutions is carried out. When outbreaks of fungal diseases occur, this work must be intensified. Experience shows that it is expedient to instruct children from the very first days of their studies.

7. Planned, daily control of barbers' work (disinfection of haircutters, scissors, razors, combs, and other things that may transmit the infection). It is forbidden to serve clients in whom fungal infection of the scalp or facial skin is suspected.

It should be noted that children must be thoroughly examined twice (at one-week intervals) after the last case of superficial trichophytosis or favus has been diagnosed at a children's institution. Within this period, new children are not admitted, and the children's hair is not cut. The linen of

children from the patient's group should be washed separately.

Regular medical checkups of patients, which increase the efficiency of dermatophytoses control, are important measures among those conducive to a decrease in the incidence of mycoses.

Medical checkups of patients with fungal diseases are performed by dermatologists and include the following measures:

- early detection of patients with mycoses followed by their obligatory registration;
- identification of sources of infection;
- examination of members of the patient's family and all his/her close contacts;
- timely treatment of patients;

control of the accuracy and efficacy of treatment;

epidemic control and disinfection measures in foci of infection;

prophylactic checkups of children's groups and attending personnel as well as other persons who must be examined according to the appropriate regulations.

These measures may vary, depending on the type of mycosis. Patients with microsporiasis, trichophytosis, or favus and also their contacts must be regularly checked.

A fungal disease is diagnosed on the basis of the clinical picture and laboratory findings obtained as a result of examining the patient's hair, scales of skin, and nails. Quartz mercury lamps with a luminescent filter can also be used to diagnose microspo-

rosis. Hair attacked by microsporum luminesces with a green color during irradiation in a dark room.

Determination of the species of causative agent makes it possible to establish the aetiological diagnosis, to define more precisely the source of infection, to prescribe adequate therapy, to reveal pathogens unusual for the given locality, and to carry out in time the appropriate epidemic control measures, depending on the species of the causative agent. All patients with dermatophytoses must be registered.

When microsporiasis, trichophytosis, or favus is diagnosed for the first time, the physician fills out a notification form for each patient, indicating the clinical form of the disease and localization of the pathological process. The notice is then sent to a local clinic of skin and venereal diseases and also to a city (regional) epidemiological control facility.

Identification of the source of infection is an important measure, which includes thorough questioning the patient and his or her relatives about any possible contacts with infected people or animals, visit to a rural locality, or the presence of rodents. All members of the patient's family and his/her contacts should be examined as soon as possible.

All children from the patient's class at school, and all children and attending personnel at kindergartens and nurseries are examined. The epidemiological features of

all types of mycoses are taken into account during the examination.

Zoophilic fungi can quite often cause reinfection in the family, and the clinical manifestations of trichophytosis and microsporiasis are usually markedly pronounced. Usually, patients themselves notice the signs of mycosis and consult a physician on their own. The clinical signs of microsporiasis of the scalp in man are often mildly pronounced, but luminescent lamps help to detect avisual forms of the disease and the affected fluorescing hair during prophylactic examinations of children.

In all foci of microsporiasis and trichophytosis caused by zoophilic fungi, clinico-laboratory tests of all family contacts should be conducted three times within two months.

Taking into consideration the specific clinical features of atypical forms of chronic trichophytosis and favus and also the particular importance of detecting the sources of infection in all cases of the disease caused by anthropophilic fungi, a dermatologist takes part in examining family contacts. The scalp and smooth skin, specifically the sites of favoured localization of chronic mycosis (buttocks, thighs, legs, palms), and also the nails are thoroughly inspected. When there is the slightest suspicion of fungal disease, pathological material must be taken for microscopic study and cultivation.

The treatment of a patient with dermatophytosis must begin not later than 48 hours

after the diagnosis was made. When in-patient treatment is not indicated or a patient cannot be hospitalized (quarantine, etc.), patients should be treated at home. It is forbidden for sick children to be in contact with other children; all patients are not allowed to visit the barber's, bath-houses, or swimming pools until complete recovery. Observance of the instructions given by the dermatologist should be checked by the clinic nurses.

Patients can be discharged from the hospital and continue treatment as out-patients after two microscopic tests (at a 5-7 day interval) with negative results.

The constant medical surveillance of out-patients after their discharge from the hospital and timely qualitative control tests are very important. This makes it possible to provide a complete course of adequate treatment and to avoid relapses.

Children can be admitted to children's groups after three tests (at 5-7 day intervals) with negative results and a final disinfection of the home. All children from the patient's group are inspected, washed, and their underclothes and bed linen changed before final disinfection is conducted at the kindergarten, nursery, school, boarding school, children's home, and other educational institutions where children stay for 24 hours. The linen of children from this group is washed separately.

When fungal diseases are detected at a

children's institution, it is forbidden to transfer children from one group into another or to other children's institution. New children are admitted to the group in four weeks after the last case of trichophytosis, favus or zoonosis was diagnosed (in six weeks in anthropophilic fungal species). If one child in a family is sick and is treated as an out-patient, then during the period of his/her treatment the other children from this family are not admitted to any children's group.

Medical personnel inform the veterinary service about any cases of dermatophytoses that have occurred in either humans or animals. The veterinary service, in turn, reports to the medical service on the measures taken (isolation and treatment of diseased cattle and other epidemic control measures at farms; inspection of cats and dogs in the places of residence of patients affected by microsporosis; organization of luminous diagnostics at veterinary clinics; treatment of pure bred cats and dogs affected by microsporosis; search for stray animals and their extermination).

A few words about the symptoms of some fungal diseases in animals, lap-dogs and cats should be added. Maculovesicular infiltrative lesions of trichophytosis in dogs are localized on the head, neck, extremities, and around the tail. The lesions may be solitary or multiple, often fuse with each other, and are covered by thick crusts. After the crusts have fallen off, the foci

remain hairless for some time until the new hair grows. Dogs may also have deep purulent and painful lesions. Rabbits, foxes, rats, mice, cats (rarely), and other mouse-like rodents can be affected by trichophytosis.

When patients are infected with zoonophilic fungal species, measures should be taken to exterminate rodents, which are the main carriers of the causative agent. Therefore, cases of this form of trichophytosis must be reported to the epidemiological facility, which should conduct rodent control in the place of the patient's residence.

Children undergo regular medical checkups at schools once a year; at kindergartens, once every three months, and at children's homes and nurseries, every month. Regular medical checkups are also carried out before children leave for holiday camps and sanatoria.

The personnel of children's institutions, dairy farms, bathhouses, showers, and laundries should be examined by physicians before they start working and then quarterly after that.

The important point in the control of microsporosis is the systematic cleaning of populated areas, restriction of sites for dumps and periodic cleaning of basements and attics.

Candidiasis

Of the more than 80 representatives of yeast-like fungi, the fungi of the genus *Candida*, mainly *Candida albicans*, *Candida tropicalis* and some others have pathogenic properties. They are usually saprophytes though they are quite often discharged from the surface of the skin and mucosa of humans and animals; under certain conditions they can become pathogens, and cause clinical manifestations of candidiasis.

Affection of the skin, mucosa and internal organs by yeast-like fungi of the genus *Candida* is called candidiasis. This disease was first described by Langenbeck in 1839. The systematic study of yeast affections began in the middle of the nineteenth century after the fungal origin of thrush, a widely spread disease among young infants, had been discovered.

In fact, thrush was the only yeast affection that was investigated for many years. The clinical picture, aetiology and pathogenesis of these diseases underwent detailed and comprehensive study only in the thirties and forties.

It was noted that many days of disability due to various skin diseases of hands were recorded among workers of canneries and confectionery factories dealing with fruits and vegetables.

It turned out that yeast-like fungi that can affect skin and mucosa vegetate on

vegetables and fruits; apples and pears starting to decay contain particularly large amounts of fungi.

In production conditions yeast-like fungi were found in fruit mixtures used for making caramels, marmalade, jam, and also candies and syrups. Usually, these fungi are saprophytes inhabiting the gastro-intestinal tract of humans. Under certain conditions, yeast-like fungi can become pathogenic for humans, thus causing various affections.

Pathogenic factors can be subdivided into exogenous and endogenous. The exogenous factors include injury, high humidity, and the action of acids and alkalis, all leading to the maceration of skin. Examples are: yeast affections of the nipples in nursing mothers, thrush, and perlèche due to poorly fitted dental prostheses. Yeast paronychia and onychia, i.e. inflammation involving the folds of tissue surrounding the fingernail, are often preceded by trauma, for instance, in manicure.

The exogenous factors listed determine the groups of people (risk groups) most susceptible to these diseases, on the one hand, and, on the other, help to elaborate preventive measures.

Thus, workers in confectionery and canning factories, personnel of bathhouses and swimming pools, dishwashers, housewives, and venders of beverages belong to the population groups most susceptible to yeast infection.

What are the 'internal factors' that weaken the defences of the body, thus facilitating the development of disease? They include infection, metabolic disorders, hyperhidrosis and impaired blood circulation in the extremities, and diseases of the gastro-intestinal tract (for instance, achylia), hypo- and avitaminoses.

Neonates and infants are very susceptible to yeast infection due to an immature immune system: the disease runs a more acute course and its clinical manifestations are more markedly pronounced. Later owing to the carriage of yeast-like fungi that live on the skin and mucosa, immunological changes occur in the human body, which decrease susceptibility to the infection.

This is why, in spite of the fact that almost all adults are carriers of yeast-like fungi, infection occurs only in the presence of predisposing factors that weaken the body's defences. The incidence of yeast infection increases in elderly patients owing to the weakened defence reaction of their body.

Numerous data confirm the fact that acute and chronic infections, malignant new-growths, and other severe conditions often lead to cachexia, drastically weaken the patient's organism, and contribute to the development of yeast affection of various organs.

Already for a long time dermatologists have been able to diagnose diabetes in patients with persistent yeast affections

that are resistant to conventional therapy, or with yeast infection of the genitalia, when its other clinical signs are not yet pronounced. It is worth noting that in such cases the insulin therapy of diabetes has a favourable influence on the outcome of yeast infection. Metabolic disorders, particularly of fat and salt metabolism, can lead to obesity. Candidiasis can easily develop in such patients on contacting surfaces of skin folds containing large amounts of subcutaneous fat.

Clinical Signs of Various Forms of Candidiasis

The clinical forms of candidiasis vary: there are candidiasis of the skin, mucosa, and nails, chronic generalized (granulomatous) candidiasis, and systemic candidiasis. Large and small folds in the armpits, the groin, between the buttocks, the fingers, and the toes are usually affected. In women the lesions are quite often located under the breasts. The lesions have festoon contours and distinct margins with a border of detaching epidermis and the so-called siftings (vesicles and pustules) near the main lesion. The main lesion is red and has a smooth and shiny surface with mildly pronounced weeping. Sometimes there is a crack in its centre or an area of macerated epidermis greyish-white in colour.

Candidiasis of the palms and soles is characterized by hyperkeratosis, manifest skin

furrows, hyperaemia, bran-like scaling, and a dirty brown colouring. There are no specific features of smooth skin affection.

Onychia and paronychia are characterized by inflammation of the nails and adjacent tissues. A specific feature of this clinical form of candidiasis is that the nail folds are first attacked, after which inflammation extends to the nail plates.

In candidiasis the nail folds are red with a cyanotic hue, oedematous, infiltrated, and moderately painful, both by themselves and particularly on palpation. The eponychium disappears, and folds are elevated above the nail plate in the form of a flat arch. When they are pressed, a drop of thick pus can appear.

The acute stage of the disease can be spontaneously followed by subacute and chronic stages when the inflammation abates markedly. Only then does the process involve the nail plate where a crumbly discharge is observed at the posterior and lateral nail borders. The nail plate becomes unevenly rough and brown and sometimes detaches easily. Transverse grooves are also observed as a result of impaired blood circulation in the area of the nail bed. Women are infected much more frequently than men.

Thrush (mycotic stomatitis) is the most widely spread candidiasis of the mucosa and is most common in children.

At the onset the disease is characterized by the formation of white spots, resembling

semolina seeds, on the oral mucosa (cheeks, palate, tongue, gums). These spots fuse to form whitish films of various size on the red mucosa.

Angular cheilitis (perlèche, yeast inflammation in the corners of the mouth). The clinical picture of the disease is almost identical to that seen in streptococcal infection of the corners of the mouth. As a rule, there are two reasons for the development of this disease: riboflavine deficiency, accompanied by changes in the red border of the lips and mucosa of the tongue, and yeast infection.

Mycotic cheilitis is an affection of the lips manifested by relative redness and sometimes oedema of the mucosa, which is accompanied by a feeling of burning, dryness, and tautness of the red border of the lips. Greyish scales are observed that appear stuck to the lips with their free edges slightly elevated.

Mycotic glossitis is a fungal infection of the tongue, which may develop as a separate disease or be one of the manifestations of mycotic stomatitis.

The films of common thrush are sometimes seen on the dorsum of the patient's tongue. Deep furrows running in different directions ('scrotal tongue') are manifest in other cases. There are whitish films on the bottom and edges of furrows indicating mycotic affection. Atrophy of papillae may be observed on some sites of the dorsum of the tongue. The tongue is some-

what enlarged in size, and the patient may complain that 'the tongue is too big for the mouth'. The imprint of teeth may be seen on the lateral surfaces of the tongue.

Mycotic tonsillitis is characterized by normal body temperature, absence of pain on swallowing; whitish films appear on the soft and hard palate similar to those in follicular tonsillitis. However, visible inflammation is absent, and occasionally the whitish films resemble the clinical picture of thrush.

Mycotic vulvovaginitis is the affection of the external female genitalia. In the initial stages of the disease the patient complains of strong itching and sometimes burning in the affected areas; the process may involve the anus. When the disease develops, whitish or greyish films, resembling those in thrush, and a typical clotted (crumbly) discharge appear on the mucosa. A wife may infect her husband who will develop balanoposthomycosis (affection of the prepuce and skin of the glans penis) or balanitis.

Mycosis of urogenital organs is widely spread among women all over the world. Recently, the number of patients affected by this type of mycosis has grown considerably. Thus, the trichomoniasis to candidiasis ratio was 7 : 1 in the pre-antibiotic era, while at present it is 1 : 4.

In addition to the increased number of patients, mixed infections have become

more common: candidiasis-gonorrhoea, candidiasis-trichomoniasis, bacterial candidiasis. Subclinical and atypical forms of the disease have developed and also chronic, persistent processes resistant to many drugs.

According to the findings of Soviet scientists (Antonyev, and others), sex partners and the newborn in the process of delivery are, in turn, infected by patients and the carriers of candidiasis; the dissemination of fungi from the vagina to other organs is common. The high morbidity rate of candidiasis (25%) and incidence of *Candida* carrier-state (20%) in parturients are connected with these processes.

According to the latest data of the Central Institute of Postgraduate Medical Training (Department of Skin Diseases), 80 per cent of pregnant women are infected with fungi of the genus *Candida*, which is three times higher than the incidence of mycotic vulvovaginitis among the non-pregnant women. Almost one in three women at the beginning of pregnancy and one in two at the end of the term are infected with candidiasis. A small percentage of pregnant women are found to have yeast-like fungi of the genus *Candida* in the womb. As a result the foetus may become infected, which increases the risk of miscarriages, stillbirths, and intrauterine infection.

How does the *Candida* infection manifest itself in pregnant women? The acute form of infection is characterized by strong

itching, burning, and copious vaginal discharge causing inflammation in the perineal skin folds. These signs subside in the subacute form though relapses may occur. Quite often the disease develops without marked symptoms and manifests itself only by the carrier-state.

In a number of cases the thrush of the newborn is also believed to be transmitted by yeast-like fungi from the mother during delivery or nursing and as a result of contact with contaminated linen and things used for the care of children (diapers, dummies, etc.). When examined, children of the first year of life (between 15 and 50 per cent) discharged yeast-like fungi from the oral mucosa.

It was noted that prematurely born babies or those born after term, whose birth was complicated by pathological delivery and aspiration of the amniotic fluid, got infected more frequently. The incidence of thrush in the neonates born to mothers infected with candidiasis is 20 times higher than in babies born to healthy mothers.

Why is candidiasis dangerous for children? In the majority of cases the disease manifests itself by thrush and concomitant dermatitides. Severe complications, such as generalized candidiasis, may develop only in debilitated children.

The incidence of yeast-like fungi (36 per cent) and mycosis of urogenital organs (22 per cent) occupies second place among workers in the antibiotic production in-

dustury; 14 per cent of these workers are carriers of candidiasis. *Candida* fungi have been detected in the same proportion (25 per cent) among patients with gynaecological conditions and workers of confectionery factories.

Prophylaxis of Candidiasis

Yeast infection (perlèche, thrush, and yeast dermatitis of the newborn) should first of all be prevented at children's institutions, and occupational candidiasis, among workers of the food canning industries.

The treatment of vulvovaginitis in pregnant women, care of the nipples in nursing mothers, and care of the oral cavity and skin in the newborn contribute to preventing thrush in neonates.

Prophylaxis of angular cheilitis (perlèche) consists in undertaking general hygienic measures at children's institutions and in teaching children the rules of hygiene (rinsing of the mouth after meals, breaking the habit of sharing an apple, putting toys, pencils, etc. into the mouth).

At fruit and vegetable factories, preventive measures are aimed at compulsory treatment of all patients and improvement of technology of production, i.e. mechanization of the main processes (avoiding contact of skin with water, organic acids and fruit syrups, care of wounds, etc.). Disinfection is carried out at factories where yeast infection may occur, for instance,

daily washing of floors and walls with a 1 per cent formalin solution or a hot solution of soda.

Individuals predisposed to yeast infection (frequent relapses) should be transferred to another job where they are not subjected to pathogenic factors (traumas, maceration). General invigorating therapy for debilitated patients who previously suffered from severe infections, vitamin therapy, and treatment of diabetes and obesity, gastro-intestinal diseases, and vegeto-neurosis are important.

Great caution should be exercised in treatment of the newborn with antibiotics, particularly those suffering from thrush and intertrigo caused by yeast-like fungi.

General principles for the treatment of candidiasis are as follows:

- suspension (general state of the patient permitting) of antibiotics, corticosteroids, and cytostatics or substitution therapy;

- treatment of concomitant, particularly endocrine, diseases (diabetes mellitus, hypercorticism) and achylia;

- prescription of a diet rich in vitamins and proteins, excluding sweets and restricting carbohydrates;

- vitamin therapy, primarily vitamins B₂, B₆, PP, C, and others;

- antifungal therapy (nystatin, levorin, amphoglucamin);

- vaccines (polyvalent, monovalent, or autovaccine);

desensitizing therapy (sodium' thio-sulphate, calcium preparations, antihistaminics, autohaemotherapy, and other means).

It goes without saying that all of the therapeutic means are prescribed and controlled by medical personnel; this also applies to candidiasis treated locally by the following means:

aniline dyes (gentian violet, methylene blue, brilliant green);

10-20 per cent borax in glycerol, powdering with 10 per cent borax, 5-10 per cent borax paste, 5-10 per cent sulphur-tar ointments and pastes;

iodine preparations: 2-5 per cent iodine tincture (applied to skin), Lugol's solution (applied to mucosa); solutions of aniline dyes;

tablets of decamine to treat the oral mucosa;

antibiotic ointments with nystatin, levorin, decamine, amphotericin, canesten.

Certain Types of Mycoses Affecting the Skin and Internal Organs

Nowadays, certain pathogens of mycoses that were not previously encountered appeared in this country due to the development of trade, cultural and transport links between countries. Soviet specialists abroad, particularly in the tropical zone, are

subjected to the danger of infection with exotic fungal diseases.

In addition to this, certain socio-ecological factors of the last decades contributed to the spread of previously unknown fungal diseases. Some representatives of fungal flora, having played no special role in human pathology before, are now recorded as active pathogens. Fungi that are usually non-pathogenic can affect both the skin and internal organs under certain conditions, e.g. massive infection. As a rule, many mycoses develop in the presence of chronic diseases, especially in the elderly or in patients weakened by severe diseases.

In the past, some mycoses were not detected or were misdiagnosed by physicians due to insufficiently developed diagnostic methods. It is not for nothing that mycologists and physicians of other specialities say, 'In doubtful cases suspect mycoses!'. Being on the alert often proves justifiable. A description of some of the fungal diseases affecting both the skin and viscera, i.e. the prevalent mould mycoses, follows.

How do they originate?

All of us have certainly seen white, green, or dark wooly growths on decaying fruits, vegetables, or other foodstuffs kept in a dark and moist place. Often a thin layer of mould forms on the surface of jam or pickles. If you blow on dry mould, a cloud of spores, potential sources of infection, immediately rises. The majority of moulds are not dangerous for humans but

in certain conditions some of them can affect the skin, mucosa, nails, and even viscera.

In recent years, affections of humans with moulds have become more common. This can, to a large extent, be explained by the wide use of various antibiotics, corticosteroids and other drugs that change the normal body's microflora (dysbacteriosis) and create conditions for the propagation of moulds on the surface and tissues of the body. Mould affections can be endogenous when the saprophytic fungi become virulent due to various circumstances, including those just mentioned.

Aspergillosis, mucormycosis, penicilliosis, and other fungal diseases are referred to as mould mycoses.

Aspergillosis. In 1847, Virchow, a famous German pathologist, found the fungi aspergilli in the tissues of a woman who had died with manifestations that resembled pulmonary tuberculosis. Subsequently, other similar cases were described, and it became clear that former finds of mycology were not accidental, and the physicians probably had been dealing with aspergillosis.

This disease is caused by fungi of the genus *Aspergillus*, which have numerous representatives that are encountered everywhere. It is known, for instance, that 1 g of soil contains up to 100 thousand fungal embryos, the majority being aspergilli. They easily reach to plants, animals,

various domestic utensils, and foodstuffs.

These fungi affect plants, animals, and individuals living on different continents. As a rule, the disease is not contagious, i.e. it is not transmitted among humans, but this does not make it less significant. From the epidemiologist's point of view, the dissemination of these fungi and the severe course of the disease induced by them are fraught with danger.

The infection is commonly transmitted by the respiratory (with dust) or, more rarely, alimentary route (*per os*), and also when the intactness of skin and mucosa is impaired. Pulmonary aspergillosis is encountered as an occupational disease in industry dealing with the production of enzymes and organic acids, the latter being manufactured with the help of aspergilli; it is also found among the workers of brewing and cotton industries, personnel of elevators and granaries. The problem of aspergillosis is also important in agriculture. Quite often domestic animals and birds get infected with aspergillosis and serve as an additional source of infection.

Otomycoses, the skin affection of external acoustic meatus, are most common. They are manifested by hyperaemia and infiltration of the skin, and occasionally by diminished hearing due to the formation of crusty scales and narrowing of the acoustic meatus. Strong itching and hypersensitivity of the skin around an auricle and sometimes annoying ringing in the ears cause

unpleasant sensations in patients with aspergillosis. The discharge from the ears is odourless and its colour depends on the fungal species: a black colour in affection with *Aspergillus niger*; yellow, with *Aspergillus flavus*, and grey, with *Aspergillus fumigatus*.

The disease is dangerous because, in addition to the external acoustic meatus, aspergillosis affects the tympanic membrane, involving the middle ear. The characteristic symptoms are itching, tinnitus, elevated temperature, occasionally stabbing and burning pain, and headache. The walls of the external acoustic meatus are inflamed and abundantly covered with grey desquamated epithelium, passing over onto the tympanic membrane. Masses of spores can partially or completely close the acoustic meatus, leading to tinnitus and diminished hearing.

Aspergillosis may also attack the bones. The most common sites of affection are the ribs and spine (especially its cervical and thoracic parts), which is the result of a pathological process spreading from the lungs to the adjacent bone tissue. Kyphosis, i.e. abnormal curvature of the spinal column, may develop in such patients.

The affections of the skin are quite varied in aspergillosis: from desquamation, intertrigo, paronychia (inflammation of nail folds), and eczematous lesions to pronounced granulomatous lesions, and subcutaneous abscesses on the face, neck,

extremities, and buttocks. Affection of the feet is manifested by hard nodules on the backs and soles, which then soften, ulcerate, and disintegrate with formation of fistulae full of purulent discharge of varying colour (depending on the pigment of the aspergilli). Quite often the bone of the foot is also involved due to an injury, for instance, when children run barefoot in forests, or meadows, or get into a swamp. The toe nails can also be affected, usually the first toes of the feet, which are most frequently subjected to trauma.

Apart from the forms of aspergillosis mentioned, diseases of the eyes, such as blepharitis, conjunctivitis, and keratitis, are encountered. Fungal diseases of the oral and nasopharyngeal mucosa are also common. Pulmonary aspergillosis and aspergilloma, the tumour-like form of localized pulmonary aspergillosis, are dangerous. The latter manifests itself by haemoptysis, cough, and other symptoms of lung affection. Allergic pulmonary aspergillosis is identified by attacks of asthma caused by the body's sensitization to the allergens of fungi. Professor Leshchenko has described the development of auto-infection by this fungus and outbreaks of acute aspergillar toxæmia associated with fungus toxins formed, for instance, in foodstuffs.

Like most other mould mycoses, aspergillosis is prevented by limiting the dispersion of fungal spores by the following measures: wearing work overalls and using

respirators at jobs that risk contamination with mould; prevention of injuries to the skin; hygiene of the body (washing after becoming soiled with dust, etc.). Taking into account the fact that aspergillosis often develops as a complication of inappropriate treatment with broad-spectrum antibiotics, polyantibiotics have been developed that contain, along with the main antibiotic, the antifungal agent nystatin.

How does infection with aspergillosis occur?

Infection with fungal spores through air, contact, and through the alimentary tract, and also auto-infection, are known. Scientists believe that there exists occupational aspergillosis. Workers in the vegetable processing industry, in factories producing citric acid, malt, or beer, in laboratories and elevators, and other individuals who have contact with moulds get infected more easily.

The mechanization and airtightness of technological processes, which exclude direct contact between humans and spores of moulds, are usually provided for in industries that use aspergilli cultures to produce various products of use in industry and everyday life. To a certain extent, this concerns granaries, malt-houses, and other places where close contact between humans and moulds is possible. As to the other mould mycoses, the preventive measures are the same.

Mucormycosis. This disease is caused by various species of fungi of the family *Mu-*

corales that are widely spread in nature and are found in soil, manure, organic remains, and damp hay. Domestic animals and poultry get infected with mucormycosis; it is also encountered among wild rodents.

Mucormycosis affects individuals in whom the body's defensive system is already markedly weakened due to previous severe and chronic diseases or for some other reason.

The clinical signs of mucormycosis are similar to those of aspergillosis and manifested by lesions of the skin, subcutaneous tissue, and internal organs; sepsis may also develop. The lungs, nasal mucosa, and paranasal sinuses (highmoritis, etc.) are commonly affected. Superficial diseases of the skin, nails, and external acoustic meatus are also encountered.

Dermatologists have described occupational mucormycosis which involves the nails and nail folds in fruit pickers. These lesions are more common in patients suffering from diabetes and diseases of the blood, particularly after long-term treatment with corticosteroids and antibiotics.

Penicilliosis. This type of mycosis is characterized by affection of the skin, nails, external acoustic meatus, mucosa, and some internal organs by fungi of the genus *Penicillium*.

Penicilliosis was first described in the last century (affection of the acoustic meatus); at the beginning of this century,

the pathogenic *Penicillium* fungi were found in cystitis and bronchopulmonary diseases. Penicilliosis is encountered all over the world but is most prevalent in tropical countries.

Penicillium fungi are widely used in the food and chemical industries, for instance, in manufacturing cheese, organic acids, enzymes, and antibiotics, and therefore can cause occupational penicilliosis.

Individuals become infected with penicilliosis mainly through the air; fungi can also penetrate through the integument (in traumas to the skin) and, more rarely, through the alimentary route, for instance, with mouldy cheese and other foodstuffs, especially vegetables and fruits.

The clinical picture of penicilliosis is similar to that of aspergillosis. Antifungal agents, particularly amphotericin, amphoglucamin, levorin, nystatin, and potassium iodide, are used for treating penicilliosis. Like other mould mycoses, penicilliosis in everyday life can be avoided by preventing mould from developing on domestic, especially kitchen, tools, utensils and food.

Mycetoma of the foot (Madura foot) is one of the forms of affection by mould. The disease was first described in the Indian province Madura, but later it turned out that this disease is encountered practically everywhere (mostly in the tropics), including this country.

Persons get infected when the fungi pen-

also some internal diseases, mainly of the gastro-intestinal tract and hormonal disorders, contribute to infection of the skin with microorganisms, including fungi.

Pathogenic fungi and bacteria can easily invade the skin injured as a result of blows, scratches, and wounds. Occasionally, almost imperceptible, minute injuries to the horny layer, following a needle prick, thorns in the flesh, sores from rubbing, and abrasions are responsible. This is why it is important to treat any microtraumas with a 2-5 per cent iodine tincture and other antiseptics.

It goes without saying that all the necessary means for treating wounds, including bandages, sticking plaster, disinfecting agents, antibiotic ointments, etc., must be included in the first-aid kit at home.

Recently, glues such as synthetic glue BPh-2 (butwar-phenolic adhesive, Soviet-made) are widely used because they are convenient for quick, lasting, and effective covering of small skin injuries. The wound should preliminarily be treated with iodine tincture or other antiseptic, and then a thin layer of glue is applied that can stick to the skin for a few days. This period of time is quite sufficient for preventing infection and for healing of the wound.

Occasionally, mechanical irritation becomes chronic, for instance, from shoes that are too tight and uncomfortable and rub the skin, leading to sores and sometimes 'water' blisters. Such injuries are com-

mon in persons whose occupation does not involve physical labour but who happen to row a boat, work with a shovel or axe, etc. As soon as the cause of rubbing is eliminated and the injury cleaned, the lesion heals in a few days.

Skin can be oily, dry or mixed, for instance, oily on the nose and dry on the cheeks. Normal skin is moderately oily and does not desquamate, and there are no comedones (blackheads) or large pores. Dry skin often desquamates, chaps, and becomes irritated. Oily skin shines, and its pores are dilated; if a piece of paper is put to skin, a greasy stain remains on the paper.

Clean and intact skin has protective properties against microbes and fungi. Thus, if a clean finger is contaminated with streptococci, their number will decrease fourfold within three hours; if the skin is soiled, then these microorganisms will multiply and can induce suppuration, for instance, of sebaceous glands or furuncle.

Of course, various microorganisms accumulate on the skin during the day. It has been estimated that more than one million different bacterial and yeast cells, and fungal spores are removed from the skin of a healthy person during washing; therefore, it is the most elementary method for preventing skin diseases.

When and how should the hands and face be washed? All of us wash every day,

etrate a wound. The initial symptoms of the disease are varied, but later the pathological process involves muscles, tendons, and bones. Amputation of the foot is required when the disease takes a chronic course. The excision of primary lesions is effective if the clinical signs of the disease are limited.

Care of Skin: The Basis for the Prevention of Skin Diseases

*Most beautiful clothes that ever have been
Are bronze of muscles and freshness of skin.*

V. MAYAKOVSKY

Many skin diseases, including dermatophytoses, develop due to poor personal hygiene and improper care of the skin. Therefore, we shall briefly describe the rules of skin care.

Physicians assert that the skin is a screen that reflects the state of health. 'Bronze of muscles and freshness of skin' are vivid signs of health. In fact, metabolic disorders and visceral dysfunction are usually attended by definite skin changes, and all of us can be convinced of this by comparing the skin of an infant, youth, and elderly person. A child has delicate, smooth, and elastic skin; a young person may occasionally have dry skin and quite often he or

she has common acne due to hypersecretion of the sebaceous glands. In old people the skin becomes flabby and wrinkled. All this reflects age-associated changes in body's functioning, including the endocrine glands.

The fact that follows testifies to the importance of skin. Once on the orders of sovereign persons Leonardo da Vinci dyed a young boy a golden colour for a New Year's ball. It was the eve of the year 1500, and the child was to symbolize the 'gold century' at hand. However, during the ball one of the court ladies fainted and the festivities came to an end; the boy was forgotten and no one washed the paint off of him. The next day the boy died from overheating and poisoning by the toxins of his own body that could not be excreted through the skin because of the layer of paint.

Cleanliness of the body is necessary for normal physiological functioning. Hygiene of the hands, feet, neck, face, hair, and nails is particularly important.

It was already mentioned that skin cells constantly die off and desquamate. The rejected particles serve as a medium for the growth of microbes and fungi. Scales, sebum, sweat, and dust that settle on the skin get mixed and turn into a layer of dirt on the body of a person who violates the elementary rules of hygiene.

Mechanical, or more rarely, physical and chemical, injury to the epidermis, and

and none of us seems to need any advice. But, as it turns out, far from all wash properly, not taking into account the features of one's own skin when using water and soap, as well as cosmetics. That is why it would not be out of place to remind once more of the rules of skin hygiene and of the ways of eliminating the microbes that inhabit it.

Water and soap wash off dirt, decomposed sebum and sweat together with microbes. Besides, the skin is massaged, and the blood supply to the skin increases during energetic washing, especially when using a brush, loofah, or sponge. The skin becomes more elastic and smooth, and the ducts of the sebaceous and sweat glands open.

The hands should be washed with soap in the morning, in the evening before going to bed, before every meal, and after going to the lavatory. The face should be washed twice: in the morning and before going to bed. Almost all kinds of soap can be used, except in skin disorders (dryness, irritation) when the soap recommended by a cosmetologist should be used.

Any soap can be used on normal skin. Oily skin should be washed with hot water. Dry skin is preferably washed with lukewarm water. For softening, the water should first be boiled or some household soda added to it.

Soap with a low alkaline content should be used to avoid overdrying the skin and

for washing children. Before going to bed, oily skin should be washed with soap but dry skin without soap.

A bath or shower may be taken daily. Hygienic shower or rubbing with a towel wetted in cold water is recommended after morning exercises. It is better to take a bath before going to bed; the procedure should not last more than 15 minutes. The temperature of water should be close to the body temperature, exceeding it only slightly. Coniferous extract (conifer tablets) and sea salt may be added, which have a favourable effect on the skin and the nervous system. A warm bath should be followed by a cool shower for the same purpose.

It goes without saying that all these recommendations are intended for healthy persons. The advice of a physician should be adhered to when water procedures are given to patients, particularly those suffering from cardiovascular diseases.

One should know about the hypersecretion of sebaceous glands in teenagers, which causes the face to become oily and shiny. Oily skin can easily inflame, and disease marked by the appearance of pustules may develop. Sweat glands begin functioning more intensively, especially in the armpits, which results in a specific odour of sweat previously not noticed by a teenager.

When pustules appear, it is better not to wash the face with water for some time

but to wipe it twice a day (morning and evening) with alcohol solutions of 2 per cent salicylic alcohol or 3 per cent chloramphenicol or a solution of calendula (one teaspoonful in half a glass of water). Before starting to take care of skin, the patient should consult a physician who is the only one to give advice.

Pustules and comedones, particularly on the face, should in no circumstances be squeezed, because this increases their number. But, the main thing lies in the fact that it is dangerous for life: the blood and lymph routes of the upper part of the face are connected with the meninges to which the infection may easily be carried.

Freckles that are common in blondes and red-haired girls often upset them. In winter freckles turn pale, but reappear markedly in the spring-summer season. Freckles do not spoil the young face; on the contrary, they make it prettier. But if they upset girls, some measures can be taken.

If the freckles are not too dark, they can be made colourless by wiping the skin with yoghurt, sour milk, a 1 : 1 solution of lemon juice and water, or the juice of fresh cucumbers. If the skin is oily, a 1-2 per cent solution of hydrogen peroxide may be used. Bleaching creams should not be used because they may irritate the skin or even make the freckles darker under the influence of the sun.

In the spring-summer season, before going out, the face should be lubricated

with creams that protect against sunlight and prevent the appearance of freckles.

Any cosmetic preparations applied to the skin will be effective only under conditions of adequate nutrition. Individuals having oily skin should try to eat less macaroni, white bread, sweets, salty and piquant food, cocoa, and chocolate. They should eat more vegetables and berries (black currants, rosehips), which contain a lot of vitamins. Foods rich in vitamin A (butter, liver, egg yolk, and carrots) are recommended for individuals with dry skin.

Hyperhidrosis of the armpits is troublesome, especially for girls. After washing, the armpits should be thoroughly wiped dry by a towel and then powdered by burnt alum (sold at drugstore) or refreshed by deodorant. Neither deodorants nor burnt alum decrease perspiration, but they eliminate the odour of sweat. Dress protectors should be used to prevent sweat from spoiling clothes.

A few words about the care of hair follow. Beautiful, thick and well-groomed hair adorn a person of any age. Women pay the most attention to their hair, but their concern is often limited to the use of cosmetics, dyes, and other means that disrupt the natural condition of the scalp.

The shine and elasticity of hair depend on the amount of sebum secreted by sebaceous glands into the hair follicles. The dryness and oiliness of hair change

with age, season, and also in the presence of some diseases, for instance, anaemia, hypovitaminosis, disorders of nutrition and digestion, but more commonly this is related to the frequent and incorrect washing of hair.

Normal hair should be washed weekly, but dry hair, more rarely. It is better to wash hair in soapsuds, rinsing it with warm water. Today, various shampoos, both home and import, are widely used. It is difficult to recommend a specific shampoo without examining the hair. You should consult a cosmetologist or choose it yourself, observing the reaction of the hair and skin.

Hair should not be washed with laundry soap, adding household soda or other alkaline substances that make it dry and brittle. Sulsenum soap should be used in dandruff, while greasy hair should be washed with a shampoo recommended by a cosmetologist. The hair may be lubricated with burdock or castor oil one or two hours before washing.

It should be mentioned that not everyone knows how to comb hair, this particularly concerning youths. In the morning, school-girls may in a hurry pull out the bundles of hair, trying to comb from the root the hair tangled during the night. One should always remember to be careful with hair and also be aware of microtraumas that may be inflicted to the hair combed clumsily and in a hurry.

Man has about 100 000 hairs on his head. A hair is durable and can sustain a relatively large load (more than 100 g); its lifetime is two-four years. One should protect it from falling out but one also should know that normally up to 100 hairs may fall out daily. Any unfavourable procedures, metabolic disorders, chemical, and other kinds of action can lead to an increase in hair loss. This was, probably, noticed by all adults. Occasionally, the hair seems to fall out for no reason, becoming stronger again afterwards.

Long hair should be combed from the ends gradually moving up to the root. The hair should be combed several times from the root to the ends to lubricate it with sebum from the hair follicles. A wide-toothed comb should first be used for combing thick hair, and then a fine-toothed comb or brush. Teasing the hair is very harmful because it breaks and small knots form. Recently, it has become fashionable for men as well as women to dye their hair, which occasionally leads to complications. Some of the dyes contain ingredients irritating the skin, and to some extent the hair may also be injured.

Dermatologists recommend that the hair should be dyed as rarely as possible and that only the approved dyes should be used. Otherwise, a person risks developing eczema or dermatitis and sometimes losing his/her hair before getting old. At the same time, some natural dyes (bas-

ma*, henna) favourably influence the growth of hair and make it stronger.

Concerning the care of nails, their tidy cutting 1-2 times a week is sufficient. This mostly concerns men and children, including young girls. The dirt under the nail plates and agnails should be controlled. The agnails commonly cause inflammation of the nail fold, as does *Candida* infection.

Children of school age should be taught how to use scissors (nailcutters) and to cut nails on their own to prevent the formation of agnails, cuts, and other traumas during this procedure. First, the hands should be washed; it is also recommended that the toe nails be cut only after a warm bath, because nails soften, become more elastic, and are treated more easily.

In case of a cut, prick or any other trauma to the skin near the nail, the injured site should immediately be treated with iodine tincture and, if necessary, a bandage applied (plaster or medicinal glue).

Daily washing of the feet should become a habit, especially during the warm season. Foot baths are helpful (5-10 min at 37-40°C). The interdigital skin folds should be wiped well but carefully so as not to injure the delicate skin. If necessary, the skin may be rubbed with lanolin or another cream, or a prophylactic* antifungal preparation.

The feet should be given special atten-

* *Basma*, plant-derived brown hair dye (*Tr.*).

tion in hyperhidrosis. When socks and stockings are rarely changed, or uncomfortable shoes, particularly rubber shoes, are worn for a long time, perspiration increases. In hyperhidrosis, the interdigital folds and soles should be wiped with cotton wool wetted in formidron. In the presence of sores from rubbing and water blisters, the feet should be soaked in a tub with potassium permanganate solution (stained pink).

How should the nails be cut?

The nails should be cut squarely but with the corners clipped slightly obliquely. Care should be taken not to injure the skin of nailfolds while manicuring and pedicuring.

There are also certain requirements to clothes and shoes to prevent skin diseases.

Linen is used not only to keep warm but also to absorb sebum and sweat. It should not irritate the skin, this particularly concerning infants whose linen is made of soft fabrics without rough seams.

Brand new linen should be laundered before use because it may have been impregnated with chemicals during the manufacturing process. Natural fabrics are preferred for manufacturing underclothes; linen made of rayon is also recommended.

Special underclothes should be worn by both men and women at night.

It should be mentioned again that to prevent mycoses the sharing of shoes is forbidden, even in one's own family, especially for children.

Now a few words about the ways of irritation of the skin and the development of diseases, including fungal diseases. First of all, if a non-safety or safety razor is used, shaving accessories, particularly the small brush, should be kept clean. Before shaving, the skin should be well lubricated with creamy soap (foam), which softens the hair and protects the skin from irritation. Then, after shaving, the remaining soap should be washed off with warm water and the face disinfected with eau de cologne. Alum and iodine tincture are used when there are cuts. When an electrical or mechanical razor is used, it should regularly be cleaned of the hair and washed with alcohol; its mechanical parts should be lubricated with a special oil.

The Fate of Mycoses

(Instead of a Postface)

The author was returning home after a business trip to the North Caucasus when a fellow-traveller appeared in his train compartment. When they began talking, it turned out that the neighbour was a veterinarian at one of the large livestock state farms. Naturally, a professional conversation ensued. The author asked the veterinarian whether bald ringworm is encountered among the horned cattle stock.

The veterinarian answered quickly and sounded slightly surprised: 'Don't you know that owing to vaccinations the bald ring-worm has not been encountered in horned cattle stock for already a number of years?'

The author knew about a recently invented vaccine that protects fur-bearing animals against *Trichophyton gypsum*. This kind of fungus is widely spread among mouse-like rodents and many other wild animals living in the natural environment. The fungus attacks domestic cattle and various species of valuable fur-bearing animals, such as foxes and polar foxes. The danger of epizootics as well as outbreaks of fungal disease increases in cage fur farming. Affecting the skin of animals, trichophytosis, for instance, largely spoils the quality of fur.

The new vaccine drastically decreased the incidence of fungal disease among the animals in fur-breeding farms leading to an increase in the output of high quality furs.

Thus, effective prophylactic vaccines had been introduced into the two main types of animal-breeding farms to control pathogenic fungi.

'How are things going with the prevention of mycoses in people?' the author's companion asked.

There are no mycoses in this country that demand specific vaccination for people. Dangerous mycoses are rarely encountered, and as for the widely spread dermatophytoses, non-specific preventive mea-

asures, primarily hygienic ones, are quite sufficient. Therefore, personal and social hygiene is the most important prerequisite for the prevention of fungal diseases of the skin.

In fact, does the vaccination of children, for instance, against microsporosis or trichophytosis make sense when these dermatophytoses are easily prevented by the observance of the elementary rules of hygiene and sanitation? Obviously, it is better to teach children these simple rules than to subject them to the painful procedure of injection (to say nothing of danger of the body's sensitization after vaccination).

Thus, the fate of many kinds of dermatophytoses and some mycoses depends to a great extent on whether the preventive measures against fungal diseases are carried out among the different strata of the population. Only some rare mycoses demand that additional specific preventive measures be taken, for instance, among Soviet specialists leaving for tropical countries.

This book mainly dealt with dermatophytoses that are commonly encountered in this country. The reader was informed about the basic features of clinical picture, epidemiology, and prevention of fungal diseases of skin.

It should be mentioned that in this country out-patient clinics for skin and venereal diseases have established a system for qualitative and effective control of dermatophytoses, which has facilitated their prevention and the decrease in their incidence.

Index

- Acne, juvenile 15
Actinomycosis 35
American blastomycosis 34, 39
Amphoglucamin 117
Amphotericin 109, 117
Angular cheilitis 103
 prophylaxis 107
Aniline dyes 109
Antibiotic ointments 109
Archimycetes 28
Arrhenius, Svante 20
Ascomycetes 28, 29
Aspergillosis 43, 111-113
 allergic pulmonary 114
 prevention 114
 pulmonary 112
 spread 115
 symptoms 111
 transmission 112
Aspergillus 42, 43, 111
Aspergillus flavus 113
Aspergillus fumigatus 113
Aspergillus niger 113

Basidiomycetes 28
BPh-2 120
Brilliant green 109

Candida 29, 30, 40, 79, 105
 carrier state 105
Candida albicans 98
Candida tropicalis 98
Candidiasis 39, 41, 98
 clinical signs 101
 incidence 104
 of palms and soles 101
 pathogenesis 99
 in pregnant women 105
 prophylaxis 107-109
 of respiratory tract 41

Canesten 109
Chromophytosis 39, 47
Cladosporium 43
Coccidioidomycosis 39, 40
Cryptococcosis 39

Decamine 109
Dermatophytes 30
Dermatophytoses 8, 34, 52f
 control 89, 91-97
Dermatophytosis furfuracea 47
Dermis 12
Dyshidrotic epidermophytosis 55
 course 55
 symptoms 55

Enzymes 21
Epidermis 10
 basal layer 10
 clear layer 11
 granular layer 11
 horny layer 11, 16
 prickle-cell layer 11
Epidermophytids 57
Epidermophyton 52
Epidermophyton floccosum 53
Epidermophytosis 52
 acute 56
 causative agent 53
 course 53
 of feet 54
 of nails 56
 symptoms 53
 treatment 54
Epidermophytosis cruris 53
 manifestations 53

- Erythrasma* 49
 causative agent 49
 localization 49
 primary lesions 49
 treatment 50
- 'Farmer lungs' 42
Favus 77, 78
 atypical form 77
 diagnosis 77
 distribution 77
 Fleming, Alexander 21, 22
 Fungal allergy 41
 Fungal diseases
 of feet 84
 prevention 84-87
 of skin 46
 Fungal species 19, 35
 anthropophilic 35, 36
 zoophilic 35, 36, 39
Fusarium 43
- Generalized rubromycosis 60-61
 Gentian violet 109
- Hair 13
 care 126
 coarse 13
 dawny 13
 long 13
 Hyperhidrosis 125, 129
 Hyperkeratosis 12
 Hyphae 25
 Hypothesis of 'panspermia' 20
- Intertriginous epidermophytosis 54
 course 55
 lesions 54
 Iodine preparations 109
 Iodine tincture 54, 120
- Keratomycoses 47
- Levorin 109, 117
 Lugol's solution 109
- Macroconidia 26
 Madura foot 117
- Methylene blue 109
 Microscopic fungi 20
 Microsporosis 37, 72
 epidemiology 73
 incidence 75
 of scalp 74
 source of infection 73
 symptoms 75, 76
Microsporium audouinii 72
Microsporium canis 33, 73
Microsporium distortum 73
Microsporium ferrugineum 36, 72, 74
Microsporium lanosum 33
 Mould mycoses 39
Mucor 25, 43
 Mucorales 116
 Mushrooms 19
 Mycormycosis 115
 causative agents 116
 clinical signs 116
 lesions 116
 occupational 116
 Mycelium 25
 Mycetoma 39
 of foot 117
 Mycosis(es) 29, 38
 control 83
 dissemination 39, 109
 of feet 79, 81, 109
 incidence 38, 41
 laboratory tests 82
 origination 110
 pathogenesis 80
 spread 38, 110
 types 109
 of urogenital organs 104
 Mycotic cheilitis 103
 Mycotic glossitis 103
 Mycotic stomatitis 102
 Mycotic tonsillitis 104
 Mycotic vulvovaginitis 104
- Nails 13
 Nystatin 109, 117
- Onychia 102
 Onychomycosis 56
 Otomycoses 112
- Parasites 27
 Paronychia 102
 Pasteur, Louis 21
 Pathogenic fungi 27
Penicillium 25, 116

Penicillium notatum 22, 42,
43, 117
Penicilliosis 116
clinical picture 117
treatment 117
Piedra nostras 50
Pityriasis versicolor 47
clinical features 47
course 48
diagnosis 48
manifestations 47, 48
Potassium iodide 117
Pulmonary aspergillosis 114

Ringworm of toes 53
Rubromycosis 57
of feet 58, 59
generalized 60
of hands 59
lesions 59
types of affection 58

Saprophytes 27, 40
'Scrotal tongue' 103
Sebaceous glands 12, 15
function 15
Sensory receptors 13
Skin 10, 17, 18
function 10, 15, 16
layers 10
structure 10
types 121
Skin diseases 118
prevention 118, 130
treatment 120
Sporotrichosis 39
Squamous epidermophyto-
sis 55, 56
Sweat glands 12
function 15-17

Thrush 102, 103
Tinea imbricata 51
clinical picture 51
course 52
distribution 52

symptoms 52
treatment 52
Trichomycosis axillaris 51
symptoms 51
treatment 51
Trichomycosis nodosa 50
manifestations 50
treatment 51
Trichonocardiosis 51
Trichophyton 37
Trichophyton gypsum 62,
68, 131
Trichophyton interdigitale
53
Trichophyton rubrum 57
Trichophyton schoenleinii 77
Trichophyton tonsurans 61,
67
Trichophyton verrucosum 62,
67, 71
Trichophyton violaceum 62,
67
Trichophytosis 61
in animals 67
chronic in man 64, 65
infiltrative 69
in man 62
of nails 64
pathogens 62
of scalp 62, 63
of smooth skin 63, 64
suppurative 69, 70
Tropical ringworm 51
Tsiolkovsky, K.E. 20

Vinci da, Leonardo 119
Vulvovaginitis 107
treatment 107

White piedra 51

Yeast 21
Yeast infection 108
prophylaxis 108
Yeast-like fungi 8, 17, 43
dissemination 41

TO THE READER

Mir Publishers would be grateful for your comments on the content, translation and design of this book. We would also be pleased to receive any other suggestions you may wish to make.

Our address is:

Mir Publishers

2 Pervy Rizhsky Pereulok

I-110, GSP, Moscow, 129820

USSR



25
Professor Sheklakov, D.Sc. (Med.), Honoured Scientist of the Russian Federation, is the author of more than 250 scientific articles and 5 monographs devoted to the problems of mycology and control of fungal diseases. Many candidates and doctors of medical science who work at research and therapeutic institutions in this country were brought up under his guidance. At present, the author is Editor-in-Chief of the journal *Vestnik dermatologii i venerologii* and works as a consultant to the Moscow Mycological Centre. He also takes an active part in public health education by writing for periodicals and delivering lectures.